CITIZEN'S POLICY GUIDE TO

ENVIRONMENTAL PRIORITIES FOR NEW YORK CITY

1974-1984

New York Council on the Environment of New York City

I Energy

COUNCIL ON THE ENVIRONMENT OF NEW YORK CITY • 51 CHAMBERS STREET, N.Y., N.Y. 10007 (212) 566-0990

Citizen's Policy Guide to Environmental Priorities

For New York City, 1974-1984

Part I

ENERGY AND THE NEW YORK CITY ENVIRONMENT

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Preface

The "energy crisis" emerged in the fall of 1973 as one of the leading issues of the day. The previous spring, in May, concern for this crisis dominated discussions when the Council on the Environment of New York City with the New York Board of Trade and the Sierra Club co-sponsored a forum on the regional response to the Nixon Administration's energy policy proposals. The Presidential proposals issued thirteen days earlier were defended by his then energy advisor Charles diBona, who said that they might have under-emphasized energy conservation measures and distribution problems. It is apparent that they did.

At our May meeting Mayor Lindsay and other New York leaders called for an energy budget requiring, at a minimum, the assignment of adequate supplies of clean fuels to those regions, such as our own, that most needed them. Mandatory energy conservation measures were thought desirable. Now, in the winter of 1973-74, these appear essential and debate rages here and in Washington about how various stop-gap emergency allocation and rationing proposals could or should be implemented.

This report is an attempt to extract some order from the chaos of the current energy situation. It is the second in a series of reports of the Citizen Environmental Priorities Project of the Council on the Environment. The Council itself is a broadly-based citizens' group affiliated with the Office of the Mayor, assigned the task of advising the Mayor on environmental questions and serving as liaison with environmentally-concerned organizations and individuals in the City.

The Council's Priorities Project is an attempt to identify the decisions which must be made soon by citizens, leaders, and organizations in New York about the City's environmental priorities for the next decade, and to suggest the form these decisions should take. The project's first publication, an Interim Report of the Council's Executive Board, was released to the public in December 1973. This is the project's second report, and others--dealing with such areas as transportation, resource recovery, pollution, noise, environmental education, enforcement, and townscape--will be forthcoming in the next few months.

This document, "Energy and the New York City Environment," represents the judgements and several months' work of an energy task force composed of representatives of several sectors of energy and environmental decision-making in the City. The task force also made extensive use of comments and criticisms from a large, diverse group of reviewers, and by members of the Council's Executive Board. The range of interests, activities, and perspectives of the several dozen people involved in preparing this report made it clear from the outset that agreement would not be reached on every point to be discussed, nor does it imply complete agreement by any single contributor with the entire contents would be possible. But an attempt has been made to present dissenting voices and to make it clear where there was substantial disagreement. We are deeply indebted to each for their judgement, knowledge, encouragement and patience.

I want to thank several people on whose shoulders active preparation of this report rested, especially the Task Force Chairman, Harold Gershinowitz, whose background within the oil industry earlier and the environmental science community more recently ideally suited him for this complex task. Michael Gerrard, our trusty rapporteur and chief drafter has faithfully pursued clarity and agreement, even when it seemed that negotiations were stalemated. His skills and good humor spurred the project and have been essential. James A Scott, our Director of Communications, has contributed measurably to the quality of the whole process, especially the actual production of this report and reinstilling editorial tightness. Administrative responsibility for this and other parts of the Priorities Project has been admirably handled by Barry C. Samuel. Special credits go to Patricia Mulvaney, Joan Duddy, and Louise Bryant for untold hours of good, clean typing and to Thomas Chan for endless miles lugging drafts to reviewers.

It is the opinion of the task forces that these are the three most important energy priorities in New York City in the next decade:

1. To reduce energy consumption so that we can make the best, most efficient use of the energy we have, can reduce shortages and depletion of energy, and can lessen local and remote environmental stress caused by the use of energy.

2. To develop alternative sources of fuel, even locally, so the New York region can share with the nation the security of maximum self-sufficiency in clean energy supply.

3. To apply all reasonable and attainable environmental safeguards, including pollution control and clean fuel requirements, so that environmental disruption here and elsewhere is kept at a minimum.

In its broad outlines, the task force concluded, an energy policy can be formulated only by the federal government. In detail, however, patterns of energy supply and use vary greatly from one region to another. Since New York City has distinctive energy problems, the City should have its own energy policy. It is, for instance, one of the places in the country hardest hit by the gasoline shortage. It is the responsibility of the administration and the citizens of New York not only to do everything they can to balance their energy needs against threats to the environment, but also to make sure the City's particular needs are considered in the formulation of state and national policy. Aggressive leadership by the incoming City Administration is urged and welcomed.

The task force addresses itself to the form energy policies should take, the logic and data behind them, and to means available to implement them. This is not primarily an attempt to propose ways the City should get through the winter of 1973-74, nor does this report generally try to incorporate all the recent day-to-day events in the energy situation, nor to analyze such possible actions as gasoline rationing which are the exclusive domain of the federal government. The principal concern here is the environmental impact of energy policies, short, medium, and long-term, and the relationship between the current crisis and long-term energy planning. The task force realizes that the need for energy in some instances can overcome for a time the need for adherence to certain levels of environmental quality, particularly when those levels are not directly related to the public health. But it discourages excessive or indefinite relaxation. The report includes a comprehensive discussion of the trade-offs that may be required to achieve both an adequate supply of energy and a healthful and pleasant environment here in New York City.

The Council wishes particularly to express its sincerest appreciation to those foundations and corporations whose grants and contributions have supported the preparation of the Interim Report. They include: The Rockefeller Foundation, the IBM Foundation, the New York Telephone Company, the Mobil Foundation, the Reuben H. Donnelly Corporation, and Brooklyn Union Gas Co. They exercise no control over the project and bear no responsibility for its results.

Ruben S. Brown
Director
Council on the Environment
of New York City

Energy, from its sources to its ultimate uses, is the cause of some of the most severe threats to the quality of our environment. Abundant, readily available and resonably priced energy is essential to our western industrial society in general and to day-to-day life in our cities in particular. The truth of these statements has never been more clearly evident than today. Both the immediate fuel crisis and the growing pressures to convert to even more polluting fuels are giving rise to major environmental problems in New York City, which is particularly vulnerable because virtually all its energy is brought in from outside and because its high density intensifies environmental threats.

The confusing pattern of brownouts, fuel oil shortages, and gasoline droughts experienced in the past year and resulting sacrifices and inconveniences are early symptoms of an energy crisis which will get worse before it gets better. The Arab oil cut-off merely hastened the arrival of the crisis. We have learned with a jolt that fuel shortages will be a constant part of American life for years to come. Between now and the early 1980's, when we hope some new technologies, construction programs, and previously expensive or inaccessible fuel sources will begin to help substantially, shortages of all forms of energy will plague the nation and the New York region.

An immediate impact will likely be dirtier air for the City, as utilities and buildings are forced to burn dirtier fuels--coal and high sulfur oil--to avoid going without fuel at all. But without proper planning even these fuels will come into short supply, even if Middle East embargos are lifted. The current crisis, painful as it may be, fortunately forces us to take measures now that we might delay if available fuel supplies were to follow a more gradual course towards ultimate depletion.

One of the most important decisions we face is what mix of fuels will be used in the City, in what quantities, and for what specific uses. A detailed chart depicting the flow of energy from sources to uses in the New York region during 1970 can be found in Appendix (I), which was prepared by Brookhaven National Laboratory. The chart shows how different forms of energy--oil, coal, etc.--pass through their various stages from extraction to end use in New York. Current energy patterns can be changed and different mixes of fuel employed, since the different forms of fuel can indirectly take the place of each other--that is, though heavy oil cannot be used in all places where natural gas is now burned, for instance, an increased supply of heavy oil will free some natural gas for other uses and perhaps lessen the need for coal. Transitions can be made, though not always without temporary dislocations and economic outlays. How the fuel mix has been changing over the past two decades can be seen in Figs. 1 and 2.

One important way the fuel mix can be improved is to alter the proportions of different fuels produced from crude oil by refineries.(1) The production of gasoline, demand for which can be reduced through restrictions on automobile traffic, should be cut back to allow an increase in production of No. 2 fuel oil, which is used in heating small homes, in firing combustion turbine plants, and in blending with the heavier No. 6 fuel oil to reduce its sulfur content. (No. 6 oil is used in large electric utility boilers and in space heating for large buildings.)

Currently, gasoline accounts for 46% of the production of U.S. refineries; No. 2 oil and diesel oil, 22%; jet fuels, 7.5%; No. 6 and other residual fuel oils, 6.6%; kerosene, 2%; lubricants, 1.6%; and other products (petrochemicals, asphalt, tars, etc.), 14.3%.(2) As the Federal Energy Office has requested, the relative proportion of gasoline should be decreased and No. 2 oil increased.

Another way to improve New York City's fuel mix is through the national allocation of clean fuels. Allocation cannot be simply an equitable distribution of the total quantity of fuel available. One irony of energy flow in the United States is that many relatively undeveloped areas are able to burn the cleanest fuels, because of their proximity to the sources; their air is much purer than needed to protect health and property. But major urban centers with already dirty and harmful air must often rely on fuels high in sulfur and ash, further aggravating pollution problems. Places like New York City should have priority in obtaining the cleaner fuels, as has been suggested by both former Mayor Lindsay and Russell Train, head of the U.S. Environmental Protection Agency.

The federal decision to allow Con Edison to burn coal at one of its plants is precisely the sort of thing which a clean fuels allocation program would prevent. Such a program would require making public a huge amount of information which is now kept secret by the energy companies. Federal legislation would probably be needed to obtain these data and, though it might take several years for such a bill to get through Congress, there is no better time than now to start.

Figure 1

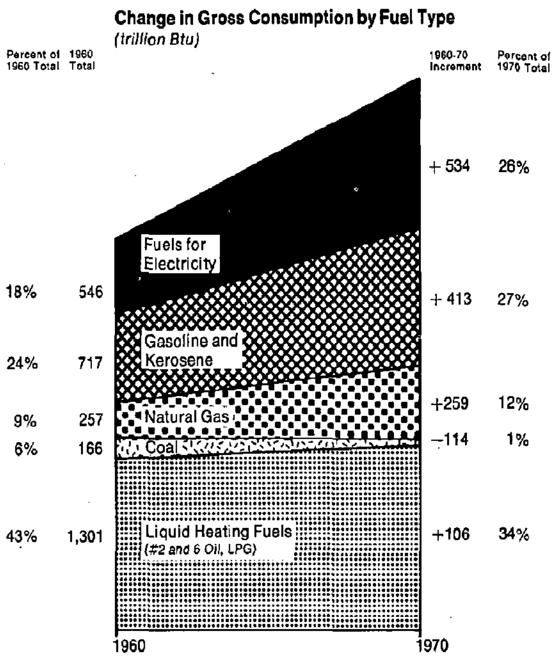
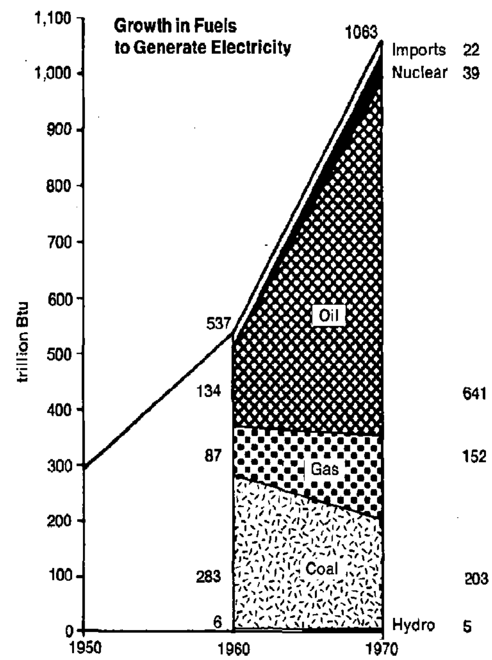


Figure 2



"Regional Energy Consumption," Regional Plan Association and Resources for the Future, December, 1973. 31-County region.

Reducing demand for energy

Before October, 1973, total energy supplies had not been dropping; they had merely failed to increase as rapidly as demand. (See Figs. 3,4.) A surplus of demand was inevitable and it only arrived sooner because of the Arab embargo. Rapid annual growth between 1960 and 1970 in local energy consumption patterns is evidenced in Appendix II. It is obvious that serious efforts to reduce demand must continue even if the flow of Arab oil resumes soon. Fuel will remain in short supply, and even if it were more plentiful, energy conservation would be desirable because the extraction, conversion, transportation and use of energy are intrinsically disruptive to the environment.

Figure 3

TRENDS IN U.S. PETROLEUM PRODUCTION, CONSUMPTION, EXPORTS, AND IMPORTS

[Thousand barrels daily]

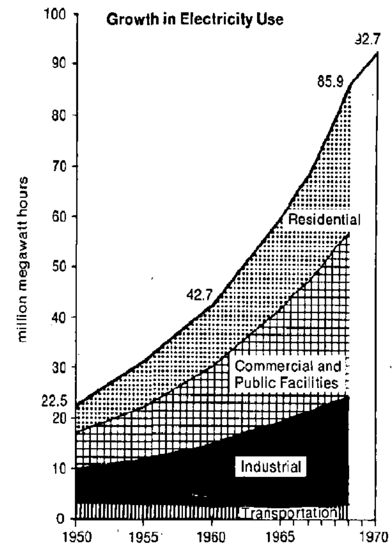
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	Yearly change [1] (percent) 1972 over 1962	Yearly change [1] (percent) 1972 over 1967
Production:													
Crude oil	7,330	7,540	7,615	7,806	8,265	8,810	8,625	9,240	9,635	9,465	9,456	+2.6	+1.5
Natural gas liquids	1,020	1,100	1,155	1,210	1,225	1,410	1,565	1,590	1,680	1,665	7,733	+5.3	+4.1
Consumption [2]	10,235	10,550	10,815	11,300	11,860	12,280	13,623	13,615	14,350	14,846	15,880	+4.5	+5.4
Exports	170	210	200	160	200	310	288	230	260	220	228	+2.5	-6.6
Imports	2,030	2,126	2,260	2,478	2,578	2,540	2,810	3,176	3,420	3,938	4,748	+8.5	+13.3

[1] Based on weight.
[2] U.S. processing gain has been deducted from total domestic product demand.

Source: British Petroleum Statistical Review of the World Oil Industry, 1972, British Petroleum Company, LTD.

(Congressional Record, November 13, 1973, p.E7253)

Figure 4



("Regional Energy Consumption")

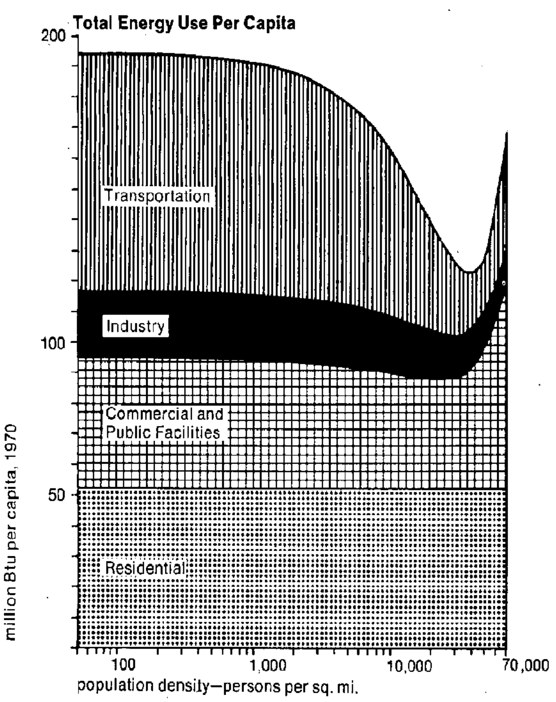
Methods of energy conservation can be short-term, medium-term, or long-term. They can be voluntary, encouraged by economic incentives, required by laws and regulations or made mandatory by denial of supply. They can seek to alter appliance use patterns or to improve the efficiency of those appliances. Some combination of all these approaches is clearly called for. The flow of energy in this society is haphazard, unplanned, wasteful, predicated on the "cowboy economics" of limitless supply.(3) The time has come to convert to "spaceship economics," to eliminate inefficiencies, distortions, and extravagances caused by low energy prices, politics, and tradition and frozen by government, corporate and individual intransigeance.

Over the last decade, the demand for gasoline in the U.S. has risen 50%; for heating oil, 18%; natural gas, 65%; and electricity, 105%. Before the Arab embargo, it was popularly accepted that the demand for electricity would double again in about ten years (twenty in New York City), though there is serious question how realistic these projections were.(4)

Fortunately, New York and most other large, dense cities are intrinsically more energy efficient than other areas (See Figs. 5, 6). This is due primarily to an extensive mass transit system, which is far less energy-intensive than automobiles, and the absence of energy-intensive heavy industry. In fact, New York City has a <u>per capita</u> consumption of energy 45% below the national average, even though <u>per capita</u> income is higher than

Figure 5

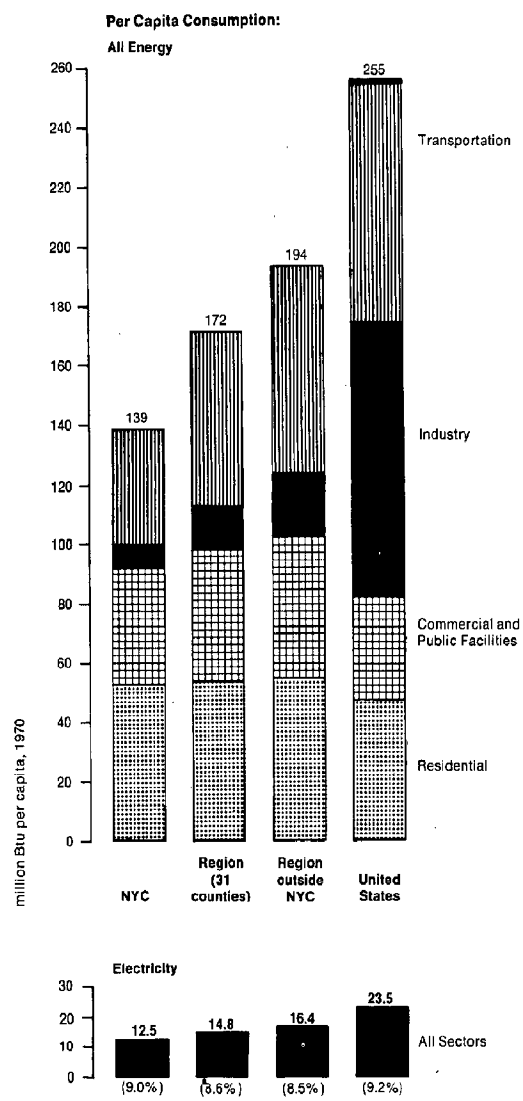
THE EFFECT OF DENSITY



"Regional Energy Consumption"

Figure 6

LEVELS OF CONSUMPTION



the national average; per dollar of money income, energy consumption in New York City is less than half the national figure.(5) Unfortunately, this high density also aggravates the effects of pollutants, makes demand for energy less flexible and makes the City more vulnerable to disruptions in energy supply.

This is why national, across-the-board requirements to reduce energy use by a certain percentage are unwise, and it is somewhat encouraging to note that the national administration is beginning to recognize this. Even so, opportunities to reduce energy demand in the City are legion.

It is unlikely, however, there can be any major reduction in total energy demand without significant changes in the life-styles of New Yorkers and in the practices of their businesses and governments. The present crisis gives incentive for, and puts the public in the mood to accept, changes and disruptions (6) as long as it appears that public officials and large institutions are making sacrifices as well.

Many of our conservation recommendations, which attempt to be illustrative rather than comprehensive, are already being considered and we wish only to add our voice in support. Others may have already been implemented by the time this report appears, just as many which the task force intended to advance in the early stages of the preparation of this report are already in force at this writing.

One category of conservation measures which affects all New Yorkers is the purchase and use of home products and appliances. These are among the actions which should be considered to reduce household energy demand:

----Label for energy consumption and efficiency such large appliances as air conditioners, self-cleaning ovens and frost-free refrigerators.(7) (A voluntary labeling program for air conditioners is already underway.)

----Set minimum efficiency standards for these appliances.

----Impose bans or heavy taxes on appliances where the power required may be out of proportion to the benefit (such as self-cleaning ovens), or whose use is counter-productive to conservation programs (such as portable electric heaters).

----Institute public education programs (such as that now being undertaken by the New York City EPA).

----Encourage use of recycled items, whose production is far more energy-efficient than that of new products.

Eliminating certain frivolous energy uses such as electric can openers is cosmetic (if symbolic), because their contribution to electric load is infinitesimal. (See Fig. 7) Additionally, restricting through taxes or bans the sales of such products as air conditioners, which in summer can be essential to minimum comfort, raises serious equity problems. One study, for instance, found that, of those earning over $15,000 a year, 58% own at least one room air conditioner; but only 28% of those earning from $5,000 to $10,000, and 11% of those earning under $5,000, had air conditioners. In all, 40% of the whites and 8% of the nonwhites owned air conditioners. (8) We should not introduce methods of reducing consumption which will make more difficult the efforts of the underprivileged to achieve social and economic equality.

Fig. 7

ENERGY CONSUMPTION BY HOME APPLIANCES AND LIGHTING

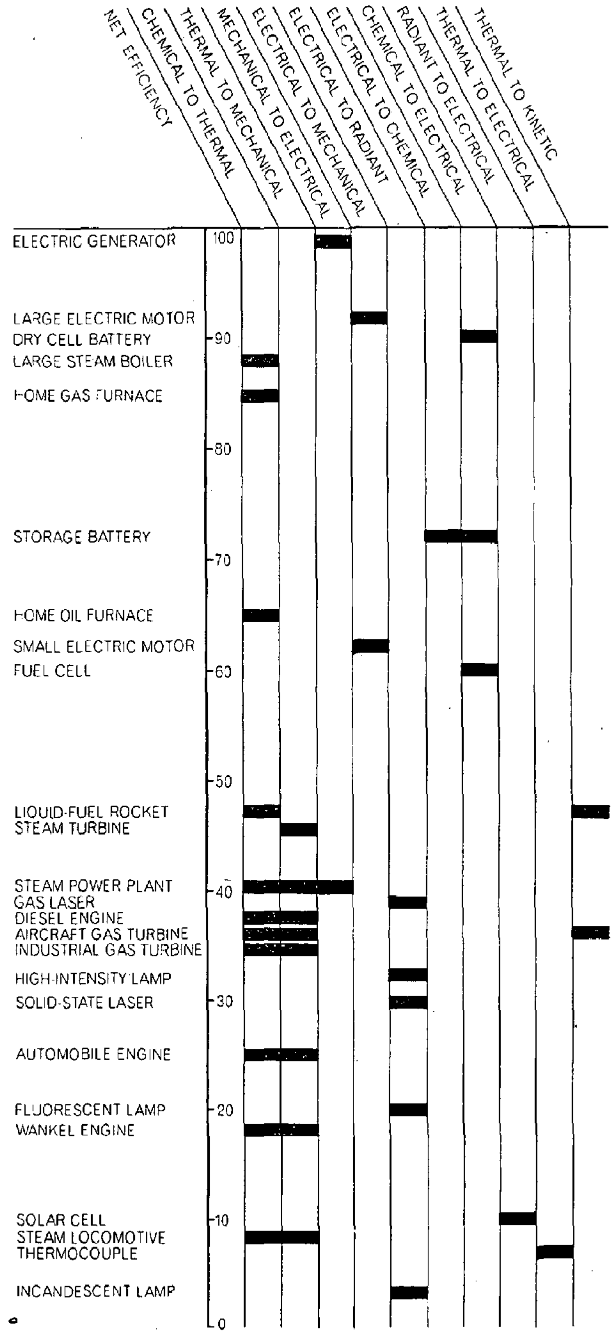
	Annual Energy Consumption (kilowatt-hours)		Annual Energy Consumption (kilowatt-hours)
Air Conditioner	2000	Hot Plate (2 burner)	100
Electric Blanket	150	Iron (hand)	150
Can Opener	0.3	Light Bulbs	1870
Clock	17	Radio (solid state)	20
Clothes Dryer	1200	Radio Phonograph (solid state)	40
Coffee Maker	100	Range	1550
Dishwasher (with heater)	350	Refrigerator (frost-free) (13 cu. ft.)	750
Fan (Attic)	270	Sewing Machine	10
Fan (Furnace)	480	Shaver	0.6
Fluorescent Light (3 fixture)	260	Television (black/white)	400
Food Freezer (16 cu. ft.)	1200	Toaster	540
Food Mixer	10	Vacuum Cleaner	45
Food Waste Disposer	30	Washer (automatic)	100
Frying Pan	240		
Hair Dryer	15		

Source: Citizen's Advisory Committee on Environmental Quality, "Citizen Action Guide to Energy Conservation" (Washington: Government Printing Office, 1973).

Some seemingly trivial conservation measures are more complicated than immediately meet the eye. Candles use no electricity, for example, but they are a petroleum derivative and therefore may soon be in short supply; additionally, some candles contain potentially dangerous quantities of lead.(9) Another complicated shortage has occurred with wood burning stoves, where immediate demand has greatly outstripped available production. Manual, as opposed to electric, razors need no power, but the energy needed to heat the water most men use in shaving manually exceeds by several times the power needed to drive an electric shaver.

Figure 8

A very fruitful approach is a reduction in lighting and extremes in temperature control. Con Edison estimates lighting accounts for at least 40% of the demand for its electricity. Much of this goes to lighting unused spaces; overlighting spaces which could serve their purpose with far less candle-power or are already adequately lit during the day by sunlight; inefficient light sources, like incandescent bulbs, which are less than one-third as efficient as fluorescent bulbs (and also add more to air conditioning loads during the summer) (see Fig. 8); and other dispensable uses. Reductions in outdoor lighting, as well as the recent conversion to year-round Daylight Saving time, are



EFFICIENCY OF ENERGY CONVERTERS runs from less than 5 percent for the ordinary incandescent lamp to 99 percent for large electric generators. The efficiencies shown are approximately the best values attainable with present technology. The figure of 47 percent indicated for the liquid-fuel rocket is computed for the liquid-hydrogen engines used in the Saturn moon vehicle. The efficiencies for fluorescent and incandescent lamps assume that the maximum attainable efficiency for an acceptable white light is about 400 lumens per watt rather than the theoretical value of 220 lumens per watt for a perfectly "flat" white light.

Source: Claude M. Summers, "The Conversion of Energy," © Scientific American, September, 1971.

important first steps in this direction and it is hoped an effective program will be established to enforce outdoor lighting restrictions. Indoor lighting is an area where private actions, especially by large companies and institutions in their own buildings, can be particularly effective. The activities of the newly-established Committee for an Adequate Supply of Energy, Inc., a private group seeking to reduce commercial energy demand in the City, are a good start.

As with lighting, heating and cooling can be reduced significantly and made far more efficient without major costs to comfort or convenience. Many places are chronically overheated and this is a good time to correct that practice. In most cases, office buildings can be heated to a maximum of about 68° on winter days (68° is the minimum inside temperature allowed by state law and it is possible that a severe oil shortage would require a lowering of this limit) and air conditioned only to a certain minimum level on summer days. Similar measures can be adopted in homes but they are much more difficult to enforce directly (though rationing of home heating oil can have the same effect). Such measures have been supported by physicians.(10) Additionally, inefficient electrical resistance heating should be eliminated wherever possible, in favor of heat pumps, oil burners, or steam.

A few of the City's biggest landlords have begun a particularly commendable effort along these lines, asking tenants to conserve hot water, lower thermostats, close doors properly to retain heat, remove rugs and furniture blocking heating units, place aluminum foil between radiators and walls, and so forth.

These landlords are having boilers and valves overhauled and clothes washing machines converted to cold water only; installing new thermostats and weatherstripping; caulking windows and doors; and repairing defective radiators, and they say they will make cash rebates to tenants if there are fuel cost savings to the company. Unfortunately, other landlords are using the fuel shortage as an excuse to save money by not even using the fuel available to them, leaving their tenants to suffer in the cold. Strict inspection is needed to ensure that building temperatures do not drop below healthful levels.

Better design of new buildings is a longer-range but absolutely essential measure. Since there is only a 2%-3% annual turnover in buildings in the City, these methods will have limited short-term effect. But another 15% of the energy used in existing buildings could be saved through better operation and maintenance (11) and even more by adding better insulation to existing structures, such as storm windows and doors and ceiling insulation to residences and small buildings. Thermal insulation and glazing standards, better switching controls, substitution of variable volume for terminal reheat systems, installation of polarizing screens to reduce heat gain and other measures should be required for all new large buildings. In all, it is estimated that a 50% energy saving could be achieved in new buildings with proper care in siting, design, and operation. (12) As a first step in mandating building construction codes to conserve energy, the Mayor's Interdepartmental Committee on Public Utilities is planning a major study in conjunction with Syska & Hennessy, Inc. and the Polytechnic Institute of New York.

For all large buildings and other major new construction projects, the City should require an energy impact assessment, along the lines of the environmental impact statements required by the National Environmental Policy Act of 1969. For City construction, this can be done in the form of an amendment to the Mayor's executive order of October 18, 1973, requiring environmental review of major projects. Such an energy assessment would examine the nature, scope and mix of energy requirements of a new significant project likely to require, directly or indirectly, substantial amounts of energy. Anticipated sources of energy and measures to constrain demand would have to be identified. Motor vehicle fleet purchases as well as new facilities and equipment should be included in energy assessments.

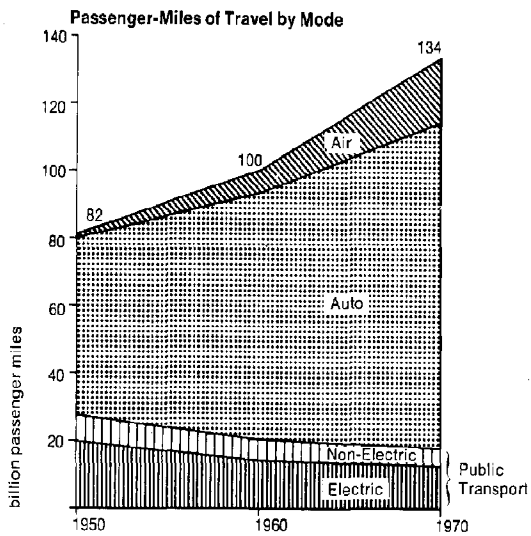
Reduction in electric voltage, put into practice in some parts of the country, including New York City, is a temporary measure and probably has little long-term application in conserving energy. The cumulative effect of long-term voltage reductions on motors and other electrical devices is unknown.

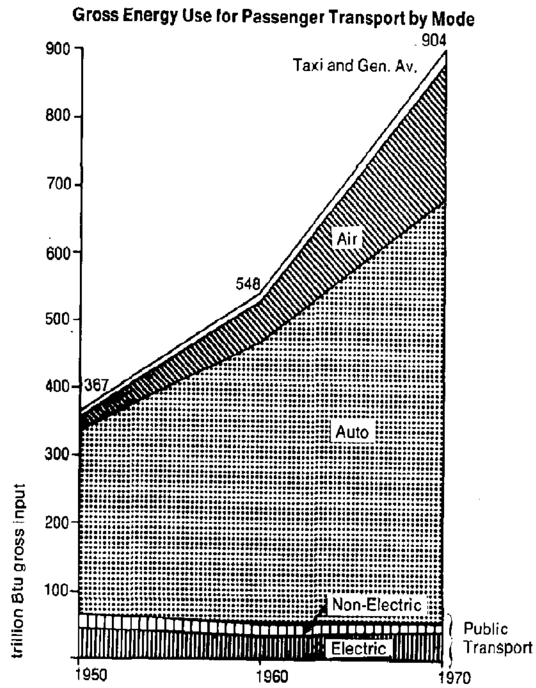
Transportation is an area with great possible energy savings. The movement of people, goods, and waste consumes one quarter of all the energy used in the City.(13) Those portions of crude oil used for transportation can easily be refined into fuels for other uses. Since mass transit is far more energy-efficient than automobiles, greater reliance on mass transit and less on the automobile is perhaps the most significant single step that can be taken for energy conservation, as well as for cleaner air and reduced congestion, as is demonstrated by Figs. 9, 10 and 11.

Figure 9

Figure 10

ENERGY FOR TRANSPORTATION





"Regional Energy Consumption." 31 Counties

Fig. 11

Energy Consumption for Transportation
(Cong. Record 11/8/73)

	Btu per passenger mile		Btu per ton mile intercity freight
	Urban Passenger	Intercity Passenger	
Bicycles.........	180	....	....
Walking..........	300	....	....
Buses............	1,240	1,030	....
Automobiles......	5,060	4,250	....
Railroads................		1,700	680
Airplanes................		9,700	37,000
Trucks................................			2,340
Pipeline................................			450
Waterway................................			540

Possible changes in New York City's transportation patterns will be discussed in some detail in the transportation report of this project, but the following list suggests some of the more fruitful actions that can be taken:

1. Discourage automobile use by banning midtown Manhattan taxi cruising; toll more bridges and tunnels into Manhattan and create a toll structure to discourage peak traffic and encourage car pools; and restrict parking in Manhattan.
2. Restrict large automobiles and engines to reduce gasoline consumption, beginning with taxis and City-controlled fleets.
3. Train more mechanics and inspectors for all motor vehicles.
4. Hasten installation of new, more comfortable subway cars and buses; improve maintenance and appearance of existing fleets.
5. Rationalize goods delivery systems to reduce unnecessary truck traffic and encourage long-distance transport by rail rather than truck.
6. Find acceptable truck bypass systems to reduce unnecessary truck travel through Manhattan's Central Business District, perhaps by providing toll incentives for trucks to use other routes.
7. Encourage land development throughout the metropolitan area in sufficient densities to permit mass transit use.
8. Continue marketing efforts to lure travelers away from cars to subways along the lines of the Metropolitan Transit Authority's apparently successful experiment with half-fares on Sundays.
9. Expand the City's system of bikeways and pedestrian areas.

In general, strict adherence to the Clean Air Act implementation plan for the New York metropolitan area, prepared by the U.S. Environmental Protection Agency, would yield many of the desired effects in energy conservation. The only significant possible exception is the provision calling for the installation of pollution-reducing catalytic converters, which increase fuel consumption, and also may emit harmful sulfates and/or toxic substances. Further examination of the effects of catalysts and possible alternative pollution control systems is needed. It should also be remembered that some measures to lure riders away from automobiles may actually encourage people to ride mass transit who would not have travelled at all before. If the induced ridership is too high in proportion to the number of people drawn away from cars, such measures can be counterproductive from an energy conservation viewpoint (though there are sociological advantages to increasing the physical mobility of low-income groups).

Energy vs. Environment?

New York City has an absolute need for both an adequate energy supply and a healthful environment, but efforts to advance one are often at the expense of the other. This does not mean that the two goals are mutually exclusive; instead, it means that the trade-offs between energy and the environment must be constantly considered and judged for the costs and benefits. Energy shortages and environmental threats are both very serious matters, and both must be treated seriously.

In the words of Russell Train, head of the U.S. Environmental Protection Agency, "Some environmentalists will have to learn that there is no point in attempting to place roadblocks in front of every effort to produce energy, that, instead, we will have to devise effective energy conservation measures and identify the most preferred methods of producing more energy to meet reduced national energy demands." Train added, "It should be clear that any approach aimed simply and solely at enlarging our energy supply is only going to aggravate what is already an acute case of galloping consumption."(14)

The energy crisis is being used by some in industry and government to try to reverse recent hard-fought advances in environmental protection. Some business interests have tried to escape investing in available control technologies and exercising reasonable cautions to a point far short of the requirements of a clean energy supply. The costs of meeting energy demands must not be met in the first instance by the individual citizen alone.

Between 1968 and 1973, average levels of one of the most harmful pollutants, sulfur dioxide, in New York City's air declined by two-thirds.(15) This dramatic improvement came about almost entirely because of restrictions on the sulfur content of fuel oil burned here. This is an achievement the City should guard very jealously. Since applications of technologies to remove sulfur dioxide from stack gases are not nearly as widespread as they might be, reversion on a large scale to dirtier fuel could mean a simultaneous increase in the incidence of respiratory disease, according to the American Public Health Association and other authorities.(16) This is a high price indeed for an adequate energy supply here in New York City, and steps should be taken in that direction only as an absolute last resort.

Guarding against unnecessarily relaxed air quality standards is a vital role for the City administration, particularly since environmental values are not economically self-enforcing. For the City to give a free hand to major fuel users would be self-destructive and it is gratifying that the City is currently granting case-by-case variances rather than blank checks. When these variances are granted, as they must be when coal and high-sulfur oil are truly the only fuels available, it is vital that they not be parlayed into long-term licenses to pollute.

Despite recent progress, many parts of New York City still have unhealthful levels of air pollutants caused by fuel burning. This means New York should be among the last places in the country to be forced further to reduce its air quality and this in turn means that New York should have a high priority in obtaining whatever clean fuel is available. Diversion of clean fuel, purchase of electricity from other areas, stringent energy conservation measures and perhaps voltage reductions should precede substantial use of dirty fuel.

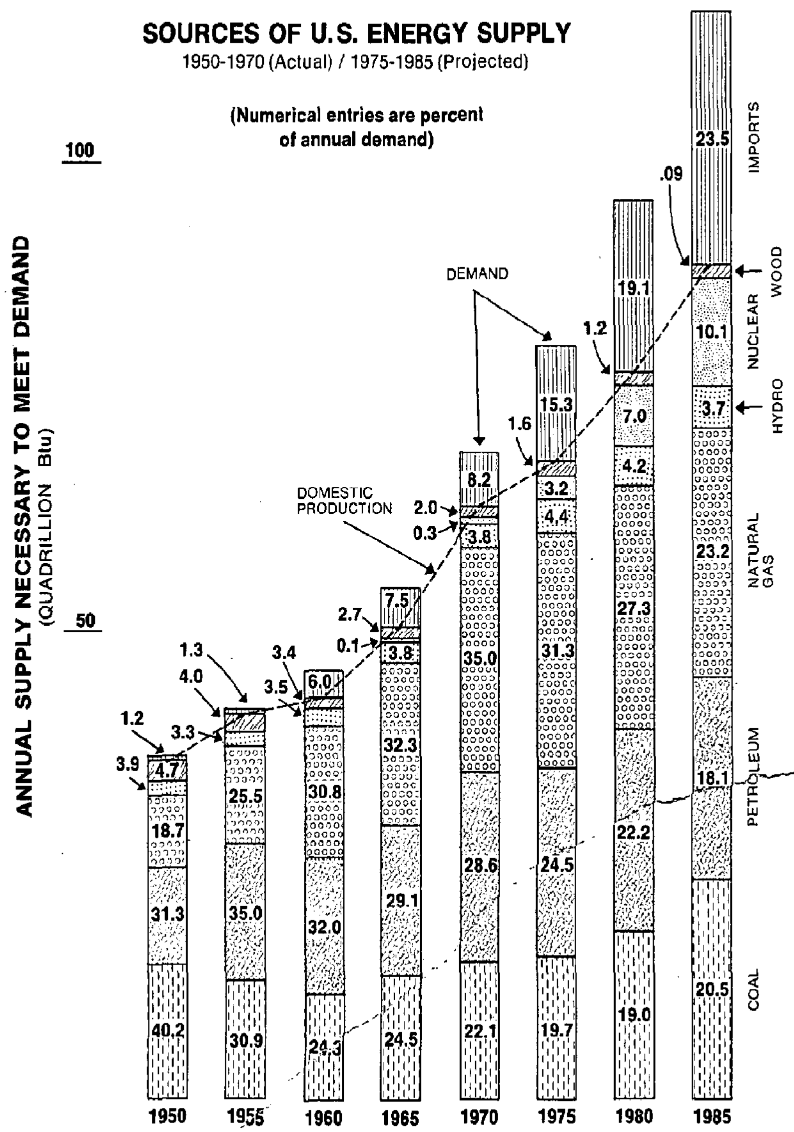
Another energy-environment tradeoff involves emission control devices on automobiles. Since catalytic converters are not yet standard equipment, the recent discovery that they have their own emissions is not relevant to short-term proposals that current emissions devices (which do <u>not</u> involve catalysts) be removed from present cars. Though the removal of these devices sometimes increases fuel economy, in other instances--due to problems of engine design, the interdependence of calibrations and other causes--it actually <u>decreases</u> fuel economy on recent model cars while it increases emissions.

Such factors as vehicle weight, horsepower and power accessories have much greater impact on fuel economy than pollution control devices. One beneficial effect of the current fuel crisis is that it is convincing the public and the auto industry of the importance of fuel economy.

Another conflict between energy and the environment arises from use of leaded gasoline, which emits more harmful pollutants than unleaded fuel, but also improves fuel economy. Some national advertising has exaggerated the impact on fuel consumption of bans on leaded gasoline,(17) again making environmentalists the scapegoats for energy shortages; despite the exaggerations, lead bans still require a significantly greater amount of petroleum. Given the well-documented harmful effects of lead in the atmosphere and the possible availability of such gasoline additives as methanol which may compensate for the absence of lead,(18) it appears that lead bans should not be sacrificed in the name of fuel conservation.

Contrary to widespread belief, environmental controls often have the effect of reducing energy demand. Though some environmental controls increase energy requirements--including automobile pollution control, secondary sewage treatment, and air pollution control at stationary sources--others reduce demand or increase supply: better automobile design, urban mass transit improvements, electricity generation through refuse burning and increased recycling.(19) One excellent example is that under the New York City Air Control Code, performance criteria for oil burners have improved fuel efficiency by as much as 20%.(20)

A major setback for coherent management of environmental protection came in December, 1973, when President Nixon shifted responsibility for radiation standards for individual nuclear power plants from EPA, which was on the verge of setting strict standards, to the AEC, which has traditionally had a more relaxed attitude toward the power plant radiation problem.(21) If EPA is further constricted the public will be the loser.



Based on pre-embargo demand projections. Source: Citizens' Advisory Committee on Environmental Quality, "Citizen Action Guide to Energy Conservation," September, 1973.

Supply of Raw Fuels

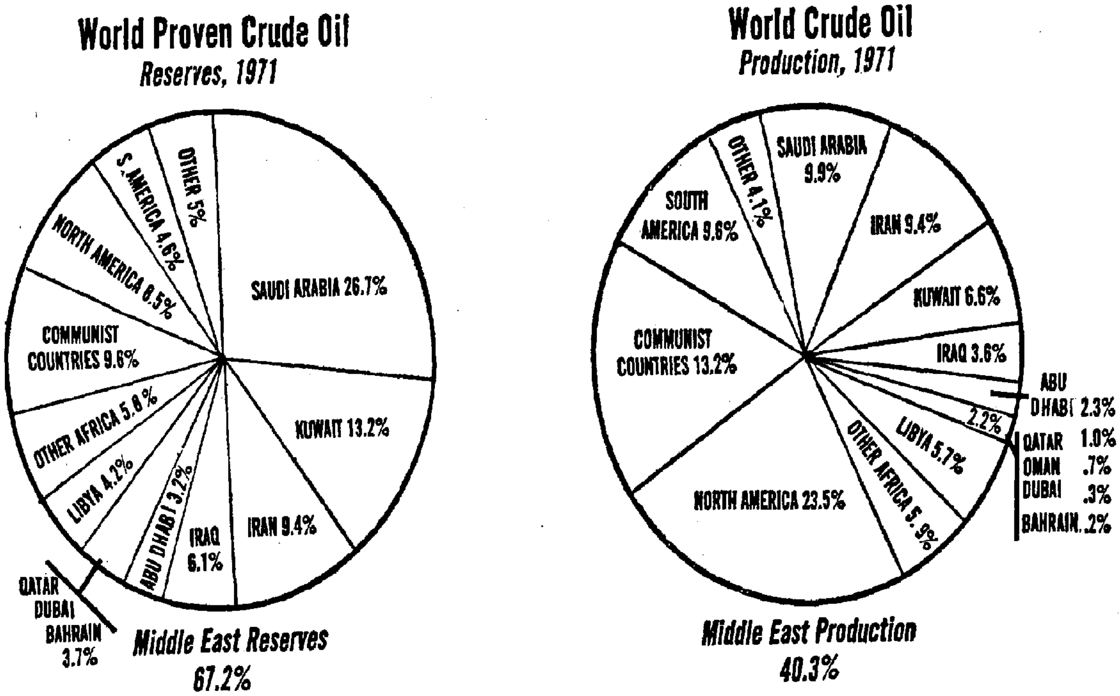
Until a few months ago, the supply of fuels had not seemed to be an extremely disruptive problem. (see Fig. 12 on sources of supply for the United States), though in the Northeast there were continuing problems with obtaining adequate supplies of clean fuel. The recent Middle East embargo, however, abruptly called attention to the generally uncertain state of our fuel supply, especially of cleaner fuels. The general sources of energy currently most desirable, natural gas and petroleum, are depletable resources. The time when the world-wide rate of discovery of new reserves will drop below the rate of consumption should be measured in decades, rather than centuries. For the United States itself, this point may well already have been reached. For coal and shale oil, especially in the United States, the prospect is more favorable. The known reserves appear to be adequate to satisfy our national needs for several centuries, if the environmental difficulties of coal and shale extraction and conversion can be resolved. Uranium is also a depletable resource but developing technologies give us growing confidence that in the long run mankind will not perish for lack of energy.

So underground reserves are not the problem now. However, if we do not develop alternate forms of energy--such as solar, geothermal, coal gasification, breeder reactors, and so forth--within the next two or three decades, and at the same time do not significantly reduce demand growth, we will be in serious trouble. Global diminution of non-renewable petroleum and natural gas reserves may then become crucial. It is possible that new technologies will have been developed, but the unpredictable nature of technological advance, as well as possible unforeseen effects from alternate sources--particularly involving the climate and the disposal of radioactive wastes--make total reliance on the "technological fix" a risky business.

In the short term, for the next decade, access to fuel reserves is the problem. A significant part of the reserves of fuel we know how to use is presently closed to us because of international politics, the long lead-times and formidable economics of developing new producing fields, and the environmentally disruptive effects of extracting, converting and using the fuels.

The Arab oil embargo is, of course, the most visible issue today in access to petroleum (see Fig. 13). Before the embargo, in the first quarter of 1973, the U.S. was relying on foreign sources for 35% of its oil,(22) with nearly 80% of that from the western hemisphere, primarily Canada and Venezuela. Only one-tenth came from the Middle East. But the nearly universally predicted increase in demand for oil meant that most of the additional supply would have to come from the Middle East. Projections estimated imports accounting for half of U.S. oil demand by 1980. The embargo has not hit the United States as hard as some other nations which are much more dependent on the Middle East for their oil. But in this country, the East Coast was importing a large portion of the Middle East oil used by the U.S., so that some 20% of the East Coast's light oil and 40% to 50% of its heavy oil came from the Arab states.(23) Con Edison reports that fully

Figure 13



© Washington Post, October 19, 1973.

60% of the heavy oil it burns came from the Middle East. (New York's particular problems are further compounded by our high dependence on independent oil distributors, who are especially susceptible to supply disruptions.)

The Middle East isn't the only petroleum-exporting region which poses problems for the U.S. Canada, facing its own shortages, has begun restricting exports and raising prices. Venezuelan oil is plagued by a high sulfur content which makes it unsuitable for many uses without special treatment. And, of course, even if and when oil flow from the Middle East is resumed, prices are likely to be much higher than in the past, due to the new militancy and enhanced economic position of the Organization of Petroleum Exporting Countries. All of this increases the desirability of maximum national self-sufficiency in energy, though there is serious question--by Atomic Energy Commission chairman Dixie Lee Ray and others--whether the goal of being able to reach total self-sufficiency by 1980 is attainable.(24)

Work on developing new sources of fuel, particularly with new federal energy research and development legislation, is going to proceed rapidly in the coming decade. Development of most of these sources--such as generating electricity with solar energy oil shale, geothermal energy, and fusion reaction--is distant from New York City in both time and place. One type of alternate fuel which the City can and should take a lead in developing, however, is the burning of waste.

Plans are now being drawn to burn garbage in two power plants in the City. The first would use one boiler unit at Con Edison's Arthur Kill generating station to use garbage for 15-20% of its fuel. Even if there are no unanticipated delays, this switchover could not be completed until Spring, 1976, according to Con Edison. The second plant, whose feasibility is now under study, would be a totally new installation, using refuse for about 50% of its fuel, and completion would not occur until several years after the Arthur Kill plant was burning refuse. A pilot plant with a similar process is now being successfully operated in St. Louis.

Burning the garbage directly for electricity may involve the release of certain toxic substances into the air. Another process with fewer pollution problems, called pyrolysis, is the conversion of the garbage into oil or gas. The Bureau of Mines has estimated that the City's 30,000 tons of refuse per day could be converted into more than 18,000 barrels of synthetic oil or 150 million cubic feet of synthetic gas,(25) not to mention the more than $100,000 per day additional that could be realized by processing and selling the metal and glass content (though initial capital costs may be high).

Either of these two methods--direct burning or pyrolysis--would generate electricity, produce revenue, and significantly reduce solid waste disposal problems. Yet another fruitful course would be reclaiming waste lubricating and other oil from motor vehicles, industrial plants and other sources. This material could be cleaned and burned for fuel, if no higher use could be found. A current economic study by the Council on the Environment of New York City reveals preliminary estimates that the equivalent of 8,200 barrels of oil are disposed of every day in 19 counties of the New York metropolitan region. Much of this oil now appears to be burned without recleaning or is dumped onto the region's land or into its waters, wasting energy and increasing air and water pollution. New York City should take the lead in speeding the development of all these potential fuel sources, with federal subsidies or bond sales to finance the needed research and development.

No fuel is now extracted from the earth's crust in the New York metropolitan area, so this is not now a problem. But there is a strong movement, spurred particularly by energy industries and utilities, toward drilling for oil and gas in the outer continental shelf, including areas off Long Island and Cape Cod. With an eye toward tripling by 1970 the amount of undersea land available to oil companies, President Nixon has directed the Council on Environmental Quality, the Environmental Protection Agency, the Department of the Interior, and the National Academy of Sciences jointly to study the environmental impacts of oil and gas development on the Atlantic shelf, to determine if the federal government should lease its undersea lands for petroleum drilling, mining, and food production. It is speculated that, if the sedimentary layers are oil bearing, the Atlantic Shelf could produce up to 2.6 million barrels of oil each day and 9.1 trillion cubic feet of gas each year--about the same amount of oil and twice the amount of gas that would be brought down the Alaskan pipeline at estimated full production.(26)

One important fear in offshore drilling is possible oil spills from platform failure, leaks, and other processes. This fear was exacerbated by the catastrophic (if temporary) effects of the platform blowout in the Santa Barbara channel in 1969. But in the past 25 years, there have been only four accidents that significantly contributed to pollution of the immediate area.(27) And the Santa Barbara well was in a narrow channel about two miles from shore, while East Coast wells, due to the geology of the region, would be from 30 to 300 miles from shore.

Extensive exploration would have to precede offshore production in any case, to determine the magnitude and nature of whatever oil and gas may exist. In view of the long lead times involved, it seems advisable that this exploration at least should proceed, particularly if the Council on Environmental Quality finds that exploration and extraction can be conducted in an environmentally sound manner. It is vital that the environmental precautions be spelled out at an early stage to insure that they will be fully taken and to provide companies an economic basis for planning further development. Metropolitan region governments should seek an important role in government decision-making on offshore drilling in any event. One issue they should be particularly concerned with is the siting of transportation, storage and conversion facilities on the shoreline, possibly endangering fragile coastal environments.

Transportation, Storage and Distribution of Fuels

Until resource recovery and energy plants are constructed, all energy used in the metropolitan area must come from fuels that are brought here and all energy must be sent from production or storage points to where it is used. Oil and gas products are brought into the New York area by ship and pipeline, and distributed within the region by pipeline and truck. Coal can be transported here by rail; electricity must be sent from generators to consumers through extensive transmission and distribution systems.

Nationally, the biggest issue in fuel transportation recently has been the Alaskan pipeline, but the one which most directly affects New York is the siting of deep-water ports. These facilities have not been necessary to date because the United States has relied so little on sources outside this hemisphere for oil. But there could be a dramatic rise in American need for external sources, especially the Middle East, the major portion of it for consumption in the eastern United States. The U.S. Department of Commerce estimates (28) that if this oil is brought here in tankers of the average size currently offloading at Atlantic and Gulf coast ports, annual transportation costs would be some 60% greater than if it were transported in ships at least five times the size of those currently in use. But the U.S. now has almost no ports which will accommodate ships that size, partly because the gently sloping nature of our continental shelf provides no natural deepwater ports, though there are at least 60 "superpòrts" now in operation in other parts of the world.(29) (Giant tankers are not totally strangers to New York, however; the largest tanker ever built in the U.S. was recently launched in Brooklyn, but it could not have floated in the harbor had it been loaded because the channel is not deep enough.)

<u>Assuming continued importation of large quantities</u> of foreign oil (and their availability, which recent events have cast into doubt) the alternatives seem to be either transshipment of oil in small ships from Canadian or Caribbean superports into the congested U.S. coastal ports, or construction of superports or offshore buoys off the U.S. coast, connected by submarine pipelines to shore installations.

The construction of such petroleum transfer facilities themselves apparently does not pose much of an environmental threat in proper settings. With offshore buoys and single-point mooring, which require no dredging, hydrological and geological problems are essentially solved. The dangers instead are of tanker breakup, mainly through collision, of oil spills in offloading and, most important, of the almost inevitable development of storage facilities, refineries, and heavy energy and petroleum-consuming industry (particularly petrochemicals) on the shores near the superports.(30) The National Academy of Sciences indicates that several current studies show that increasing tanker traffic will probably not increase substantially the annual rate of accidents leading to oil spills.(31) It appears, therefore, that with sufficient care, the problem of oil spills can be minimized to an acceptable level and that indeed Atlantic Coast or Gulf facilities for handling giant tankers would be environmentally as well as economically preferable to transshipment in smaller vessels from outside the continental U.S. The problem of onshore development would have to be faced with either mode of shipping, as well as with offshore drilling.

The question here which no public agencies have confronted, however, is whether we will need both offshore drilling and massive importation of petroleum via deepwater facilities and, if so, how much of each. Both drilling and superports have environmental disadvantages; it cannot now be definitively stated which is least environmentally harmful (nor how their effects compare with those of strip mining and oil shale extraction). There may be a need for both, since superports will help satisfy demands in the latter part of this decade, while offshore drilling can probably not begin to have much effect until the early 1980's. From an international political standpoint, offshore drilling is clearly better for the U.S. because importation carries with it the massive security and balance of trade problems inherent in dependence on foreign sources for energy. Tradeoffs among environmental considerations, economics, trade balance, and national security will have to be made; there is no way around this, so we must assure that these decisions are made consciously rather than forced upon us by time and circumstance.

Unfortunately, the institutional mechanisms for this decision-making are now lacking. Federal, state, regional, and municipal governments must all participate fully, but it is not yet clear how. If left to conventional methods of intergovernmental power politics, there is a strong likelihood that the municipal voice will be weak. So it is in the City's interest that definite procedures for decision-making about East Coast energy problems be established.

Whether the fuel is brought here by ship or is produced in offshore wells, it must be stored, processed, and transported, and the facilities needed to do this present siting, aesthetic and ecological problems. Storage tanks tend to be ugly and require much scarce land. If the tanks, as well as the loading facilities and the refineries, are located directly on undeveloped coasts, severe damage to extremely fragile coastal habitats may well result. The answer to this might be to prohibit storage, transfer, and conversion facilities from being sited on or near the shore in wetland areas; as sensitive as they are, inland regions are far less ecologically precarious than wetlands and coastal zones.

Storage capacity is not yet a major problem in the region, but it may become one. Consolidated Edison has capacity to store about 15 days' supply of fuel for power generation. But only five or six days' supply of heating oil for the City can be stored in the dead of winter, a dangerous situation if fuel sources are suddenly cut off. Lack of land on which to build storage tanks, scarcity of capital to permit stockpiling of oil, and the absence to date of adverse consequences from lack of storage capacity have combined to inhibit capacity growth. But without additional storage capacity--perhaps in the form of larger storage farms--the City becomes more vulnerable to disruptions in supplies. If the jam-up of loaded oil tankers in New York harbor in late December, 1973, was caused by lack of storage capacity, as some oil company officials maintained, the time when new storage tanks are needed may already have arrived.

The tragic accident in February, 1973, when 40 men died repairing a storage tank for liquified natural gas (LNG) in Staten Island, has led to public fears about the safety of storage tanks. (32) Though this accident has pointed out serious deficiencies in standards for the construction and maintenance of LNG tanks, (33) it does not mean that LNG tanks should not be built at all; given proper standards, these tanks can be built and operated with safety for both the workers and the public.

A related subject is the shipment by barge of LNG from the Boston area to a pier in Brooklyn. The first shipment was completed in January, 1974, without incident and the City administration feels that this practice does not present unacceptable hazards.

Storage of fuel is a complicated matter and individuals who hoard gasoline or fuel oil invite disastrous fires and explosions. Large companies which do this defeat the purpose of allocation programs and behave contrary to the public interest.(34)

In general, fuel storage, processing, and conversion facilities must be located somewhere if the fuel is to be available and there seems to be little justification for allowing this region's objections about local environmental disruption to result in exporting our pollution someplace else. Given strict protection against safety, aesthetic, and pollution problems and careful attention to siting--precautions which have been taken all to rarely in the past--we see no reason the City should oppose such facilities in this area.

Another, separate problem in fuel transportation is the shipment of coal. If air quality standards are eased, or if coal gasification plants are built in the region, as they might be if western sites are short of essential water supplies, more coal will be transported to New York, much of it by rail. But the financial predicament of the Penn Central Railroad and other lines in the East has endangered existing rail facilities. The immediate conservation of those facilities takes high priority, since it is much cheaper to maintain old tracks than to build new ones. The Northeast Regional Rail Reorganization Act of 1973 is a step in the right direction.

Electricity as well as fuel must be sent to its final destination. Recent electric brownouts in the City were not caused only by insufficient generating capacity, but also by the inability of aging distribution facilities and transmission lines to carry peak loads; some lines overheated and caught fire, while others were only put in limited use to prevent overheating. Unless these old lines are replaced on a regular schedule, new generating facilities will do little to help the peak load situations in those parts of the City served by the old lines. Con Edison boosted the preventive maintenance program for its distribution facilities only after failure in these facilities led to major power blackouts in the summer of 1972 and this program still needs improvement.(35)

Conversion

The ability to convert crude oil into gasoline, fuel oil, and other usable products is presently a crucial limiting factor in energy supply. The oil industry has said all domestic refineries are running at or near full capacity. No new overall refinery capacity has been added on the East Coast since 1957, when two new refineries were completed;(36) some highly visible attempts have been made by certain fuel companies to blame environmental restrictions. But just as or more important is the fact that domestic crude oil production stopped rising a few years ago and with import restrictions there was no need for new refineries. If it had been known that the import restrictions would be lifted this year, the oil industry argues, it might have been possible to plan to build more refineries. But, at several hundred million dollars each, refineries as well as oil tankers are not likely to be built without the certainty there will be crude oil for them. Since a new import policy was announced in President Nixon's April 18, 1973 energy message, plans have been announced for a substantial amount of new or expanded refinery capacity, though it is too early to tell the impact of the Arab oil embargo on new construction.

Some small, independent refiners, however, claim they are half-idle, unable to obtain enough crude from the giant companies. If the figures given by the independents are correct (they have been privately disputed by some federal officials), there is some doubt as to how crucial a bottleneck is constituted by refinery capacity--though the total gap between independent refinery capacity and the amount of crude these refineries can obtain is quite small in relation to <u>total</u> refinery capacity. In addition, roughly a 50% expansion of refinery capacity is possible at existing sites (with a one and one-half to three-year lead time); (37) this would further reduce the amount of new plant construction needed.

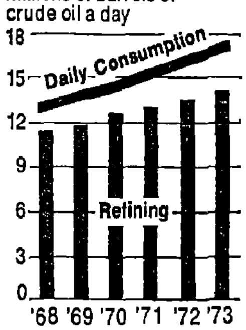
Even with relaxed environmental restrictions, refinery capacity is likely to be a bottleneck (presuming availability of crude oil) until the late 1970's; very little new refinery capacity will be added before 1976 due to construction lead times.

(See Fig. 14)

Figure 14

Oil Refining and Consumption*

Millions of barrels of crude oil a day



*Includes Puerto Rico

Source: U.S. Bureau of Mines

Biggest Refinery Expansions

Company	Location	Completion	Capacity (Barrels a day)
Exxon	Baytown, Texas	1976	250,000
Texaco	Convent, La.	1977	200,000
Standard of California	Richmond, Calif.	1976	175,000
Mobil	Paulsboro, N.J.	1977-78	150,000
Atlantic Richfield	Houston, Texas	1976	95,000
Standard of California	Perth Amboy, N.J.	1975	75,000

Source: Oil and Gas Journal

© New York Times, December 9, 1973

Most environmental disruption caused by refineries is not intrinsic in the nature of the operation and can be kept under control by adequate investment in available pollution control devices. But many communities on the East Coast have been unwilling to allow refineries to locate nearby, fearing the pollution and aesthetic problems which made older refineries such undesirable neighbors. However, if more refineries are inevitable, there seems to be little justification for the City to resist siting them here, leaving them for other regions--provided that very careful steps are taken to insure that the best available pollution control technology is installed and maintained. One major unresolved ecological problem with refineries is thermal emissions. If the heated water is discharged into waterways, some fish and other water life may be destroyed; but if cooling towers are used, major fog problems can result. There are natural draft cooling towers which eliminate fog, but those often have problems of their own.

Refineries, unfortunately, tend to attract petrochemical and other industries which make heavy use of refinery products. Since what is produced by these industries is used throughout the nation, and since the plants often still have unresolved pollution problems, there seems to be greater justification for keeping these plants out of the New York region and avoiding an increased burden on the already overloaded assimilative capacities of the region's air and water.

Another type of energy conversion facility this region may see in the next decade is coal and oil gasification plants, which permit very dirty fuels to be transformed into very clean fuels. These are particularly likely to be sited here, given the economics of shipping coal and building gas pipelines vs. the economics of transmitting electricity over long distances, and the scarcity of water (necessary for gasification and for transportation of coal by pipe) in the Western fields where much of the coal will be mined.(38) Again, if strict pollution control measures are observed, there seems to be little ground for objections to siting gasification plants in the region--particularly since the net effect of these plants on the region's air quality will be positive.

Generation

Thirty per cent of the fuel burned in New York City goes for electricity.(39) That 30%, coupled with the fuel used for space heating, accounts for most of the sulfur oxides pollution in the air here.(40) As a result, Consolidated Edison, the City's principal energy utility, has become a focal point of the controversy over the environmental effects of energy here. The company has been plagued by breakdowns of old generating, transmission, and distribution equipment and delays in startups of new facilities. There has been frequent failure to meet peak load demands on hot summer days, followed by appeals for reduced consumption, brown-outs, and finally load shedding and blackouts.

Consolidated Edison Company of New York, Inc

Long Range Electric Generation Program 1973-1992

Planned Capacity, Load and Reserve (In Megawatts)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Existing Installed Capacity	8921	8826	9269	10398	12037	12222	12417	12701	13584	14650	14650	14363	14363	14913	15463	15963	16663	17163	17863	18463	19163
New Capacity and Retirements																					
Narrows Gas Turbines	*348*																				
Bowline Point No 1		*400*																			
Indian Point No 2		*370*	*503*				*92*	*35*	*33*												
Roseton Nos. 1 & 2		*240*	*240*				*−120*				*−120*										
Bowline Point No 2			*400*																		
Indian Point No 3				*873*			*92*	*35*	*33*												
Astoria No 6				*800*																	
Peaking Plants					*440*	*220*	*220*								*500*		*500*		*600*		*600*
Cornwall Pumped Storage								*1000*	*1000*												
Base Load Plants													*1100*	*1100*		*1100*		*1100*		*1100*	
Retirements and Cold Stand-by	*−443*	*−567*	*−14*	*−34*	*−255*	*−25*		*−187*			*−167*		*−550*	*−550*		*−400*		*−400*		*−400*	
Total Installed Capacity	8826	9269	10398	12037	12222	12417	12701	13584	14650	14650	14363	14363	14913	15463	15963	16663	17163	17863	18463	19163	19763
Purchased Capacity																					
PASNY Breakabeen										500	500	500	500	500	500	500	500	500	500	500	500
PASNY MTA Plants											350	340	330	320	310	300	290	280	270	260	260
PASNY Fitzpatrick			325	310	240	235	225	215	205	195	185	170	155	135	115	95	75	60	60	60	60
Hydro Quebec						760	760	760	760	760	760	760	760	760	760	760	760	760	760	760	760
Other Short Term Purchases	778	812[3]	402	38	38																
Total Purchases	778	812	727	348	278	995	985	975	965	1455	1795	1770	1745	1715	1685	1655	1625	1600	1590	1580	1580
Total Capacity Resources	9604	10081	11125	12385	12500	13412	13686	14559	15615	16105	16158	16133	16658	17178	17648	18318	18788	19463	20053	20743	21343
Steam Deratings	−155	−120	−164	−106	−94	−101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Capacity Resources	9449	9961	10961	12279	12406	13311	13686	14559	15615	16105	16158	16133	16658	17178	17648	18318	18788	19463	20053	20743	21343
Estimated Peak Load[1]	8275	8700	9150	9550	9950	10400	10850	11300	11750	12200	11950	12440	12930	13420	13960	14500	15040	15630	16220	16810	17460
Reserve – Mw	1174	1261	1811	2729	2456	2911	2836	3259	3865	3905	4208	3693	3728	3758	3688	3818	3748	3833	3833	3933	3883
– %[2]	14.2	14.6	19.8	28.6	24.7	28.0	26.1	28.8	32.9	32.0	33.1	28.0	27.2	26.5	25.0	25.0	23.6	23.3	22.5	22.3	21.2
Reserve with Largest Unit																					
Delayed One Year – Mw		891	1227	1856	2236	2351	2616	2259	2865	3405	3108	3693	2628	2658	3188	2718	3248	2733	3233	2833	3283
– %[2]		10.3	13.4	10.4	22.4	22.6	24.1	20.0	24.4	27.9	24.5	20.0	19.2	18.7	21.6	17.8	20.5	16.6	19.0	16.1	17.9

Note

(1) Beginning in 1982, Con Edison's estimated system peak loads have been reduced by the MTA load coincident with the Con Edison peak to reflect the currently planned supply of MTA loads by PASNY

(2) Percent reserve based on estimated system peak load including MTA loads to reflect anticipated coverage by Con Edison of PASNY reserve obligation associated with MTA load in return for sale to Con Edison of excess capacity

(3) Consists of 346 Mw of committed purchases and a potential 466 Mw of purchases under discussion. Excludes additional 142 Mw (net) from PASNY which is available on a standby basis.

System Planning Department
March 13 1973

Figure 15

According to Con Edison's projections (see Fig. 15), all major stations which will provide power in the region in the next decade are probably already on line or under construction, with the exception of the two-million kilowatt pumped storage facility near Cornwall at Storm King Mountain, where a legal battle that began in the 1960's may be nearing conclusion. The plan is to create a huge basin in a mountain; during the night, when demand for electricity is low, use electricity to pump water up the mountain into the basin and during the day, when demand is high, let the water flow back into the Hudson, through turbines which will generate electricity. Advocates of the plant claim that it is the best way to satisfy peak power demands; by the time it would go into operation around 1980 it could be powered by non-polluting nuclear and other electricity sources; and that it would not have a detrimental effect on the Hudson. Opponents claim it wastes electricity, using nearly three units of power for every two it returns; that it endangers New York City's water supply and the fish population of the Hudson; and that there are more environmentally sound approaches, including reducing peak demand. In December, 1973, the City administration said it was not opposed to the project if the nearby aquaduct which supplies water to the City were not affected. The same month, the City EPA forwarded to Con Edison a proposal for handling peak load problems that would shift emphasis from a pumped storage plant at the Cornwall site to an additional series of small combustion-turbine generating stations at scattered sites. In January, 1974, the new Commissioner of the state Department of Environmental Conservation, James Biggane, called for a fresh look at the Cornwall plant and its alternatives. The issues surrounding this plant are exceedingly complex, and this task force could not reach agreement about the plan.

Plans are still in flux for smaller generating stations, particularly combustion turbine units to supplement the steam-electric stations. The jet engine-like turbines can be placed in service rapidly and at lower initial cost, but fuel costs are higher, efficiency is lower, and emissions of nitrogen oxides are higher than from other plants. Turbines as now built and operated do not appear to be a feasible long-term solution, though there is very promising work being done in the use of low-BTU fuel gas and efficient combined-cycle systems incorporating gas and steam turbines.(41) Combined-cycle systems are now virtually ready for application. Building "total energy plants," (which would produce both steam and electricity and could be installed right where they are used) can begin at various residential, commercial and industrial complexes planned in the City. These might be interconnected, along with Con Ed's existing plants, to form a "local power pool" to reduce the possibility of local outages, though this is costly. Plans should also be made for maintaining the integrity of the District Steam System.

The final question in generation of electricity is the siting of major new facilities. It takes five to eight years to plan and build a fossil fuel plant once a site has been chosen, and eight to twelve years for a nuclear plant. Alternative and perhaps exotic means of generation are not expected to begin to make any large contribution until well into the 1980's. But, for these as well as conventional plants, a more rational and orderly process of site selection is needed, as well as a true commitment to long range planning. "Unforeseen" delays in plant construction--due more often to labor problems, late delivery of equipment, and change in regulatory requirements than to environmental restrictions,(42) occur so regularly that they should be factored into completion schedules. The plant siting legislation passed by the 1972 session of the New York State Legislature is an important move toward sound siting procedures but it has yet to have major impact on the City.

One serious problem in planning new fossil-fuel plants, of course, is the long-term availability of the fuels. Since a new oil-fired plant started today could not be completed before about 1980 and since generating plants are designed to operate for a minimum of 35 years, planners must look at the world oil supply picture through the period from 1980 to at least 2015 and even far beyond that if we are unwilling to exhaust totally world oil reserves(43)--even if a coal plant can be converted into an oil plant.

Already, plans for one power plant to be built in the metropolitan region--by the Orange and Rockland Utilities, Inc.--have been postponed because of the Arab embargo and the attendant reduction in energy consumption.(44)

One suggestion which might solve a number of environmental problems at once is siting plants on artificial islands built from solid waste or on barges offshore. The former would create major opportunities for disposing of garbage without consuming land or creating air pollution by burning; either option makes the air pollution effects of the plants much less severe because the fuel is burned much farther away from where people live than if the plants were located on land; hence, perhaps, might allow for the use of somewhat dirtier fuel. If such problems as the potential for oil spills at the point where the plants receive their fuel, transmission loss, and others can be solved, this can be a promising approach to the siting of new plants in the New York region, as well as possibly to the relocation of old ones.

Economics and Energy

For many years, energy has been cheap and accessible. Consumption patterns grew the way they did largely because of the ready availability of inexpensive fuels. Prices were low because of regulatory failure; failure to factor environmental costs into fuel prices; a distorted market structure resulting from extensive vertical and horizontal integration in the petroleum business, and as reflections of energy supply and demand patterns which no longer exist. If the environmental costs of producing energy were reflected in the price of energy, environmental controls would be much more readily adopted.

Energy prices in general are in a state of considerable flux. Such factors as Federal Power Commission regulation of natural gas rates; the Organization of Petroleum Exporting Countries control over prices of oil; increasing nationalism of petroleum-exporting regions outside the Middle East such as Canada; the U.S. Cost of Living Council's Phase IV regulations, and many others have introduced considerable uncertainty into the pricing situation. It is important that New York City work toward price structures which both are equitable and contain economic incentives for efficient energy use. As Fig. 16 demonstrates, there is a wide variation in price per BTU (British Thermal Unit, a standard energy measure) among different forms and quantities of energy.

Fig. 16 Comparison of Price to New York City Area* Consumers of Various Forms of Energy (Dec., 1973 averages; includes all taxes)

Form	Amount	Price	Cost per Million BTU	Conversion Factor
Reg. Gasoline	1 gallon	$ .46	$ 3.68	124,800 BTU/gallon
Prem. Gasoline	1 gallon	$ .49	$ 3.95	125,000 BTU/gallon
#2 Heating Oil	100 gallon	$ 33.41	$ 2.40	139,500 BTU/gallon
Natural Gas	**10 therms	$ 4.44	$ 4.44	100,000 BTU/gallon
Natural Gas	25 therms	$ 8.58	$ 3.43	100,000 BTU/gallon
Natural Gas	***100 therms	$ 18.89	$ 1.89	100,000 BTU/gallon
Electricity	100 kw/hr	$ 7.02	$20.57	3,413 BTU/kw/hr
Electricity	#250 kw/hr	$ 14.17	$16.58	3,413 BTU/kw/hr
Electricity	500 hw/hr	$ 25.93	$15.18	3,413 BTU/kw/hr
Electricity	##10,000 kw/hr	$ 422.85	$12.38	3,413 BTU/kw/hr
Electricity	###200,000 kw/hr	$3,682.16	$ 5.39	3,413 BTU/kw/hr

Source: Council on the Environment of NYC, based on statistics from N.Y.S. Public Service Commission; U.S. Bureau of Labor Statistics; Mobil Oil Co.; Federal Power Commission; Consolidated Edison Co.

*17-county S.M.S.A.**Typical non-heating residential consumption.***Typical heating residential consumption.#Typical non-heating residential consumption. ##Commercial rate, @ 40 kw/hr peak demand, Mid-Atlantic states average.### Industrial rate @ 500 kw/hr peak demand, Mid-Atlantic states average.

One of the most visible aspects of this situation in New York is electric rates.(45) These rates have been exempted from federal price controls and are under the control of the state Public Service Commission. Con Edison on December 12, 1973, requested a $314.8 million, or 22.6%, rate increase over the next two years to cover increased costs and an additional increase of up to 6.7%, or $107.8 million, to compensate for loss of revenue because of energy conservation measures. Just three months earlier, the P.S.C. had granted the utility a $164.5 million rate rise, after Con Edison had requested a $191 million increase.

We will not presume to recommend P.S.C. policy on the latest rate request but we do think it is appropriate to comment on the form that changes in rate structures might take. Though data to back them up are not yet authoritative, three arguments against current rate structures are that the rates encourage excessive energy consumption; that they are regressive in charging higher rates to lower income families (46); and that they increase capital and operating costs and the need for peak generating capacity by failing to spread out electricity demand across the day. In New York, the P.S.C. has at last banned the practice of giving discounts to large users of electricity and it is hoped that whoever is the next P.S.C. chairman will continue in this positive direction. A number of promising avenues remain to be explored:

----Discourage demand at peak times by imposing rate differentials between day and night, and summer and winter.

----Segregate costs, like billing, transmission, and distribution economies in charging each customer. This way economies of scale can be accurately reflected in electric bills, similarly to the way such economies are now reflected in telephone bills.

----Design rates so that no customers are charged less than the actual cost of providing power to them. This should have the effect of lowering the rates charged low-income customers relative to others.

----Increase submetering in apartment buildings, so that tenants will be individually metered for their electricity consumption, rather than having the total cost of the building's electric load to be divided up equally among the tenants and included in the rent.

Natural gas is the only fuel whose price is traditionally regulated by the government, and it is now generally conceded that the Federal Power Commission has kept prices for this cleanest of fuels artificially low, inducing high demand for gas and at the same time making exploration for new gas fields less profitable. Since natural gas is by far the least polluting fossil fuel, environmental restrictions drastically increased the demand for gas while prices failed to rise to compensate. The FPC is now allowing price increases and total deregulation seems to be possible in the future (hopefully with provisions that increased revenues go toward further exploration). Many authorities have said that natural gas is too valuable a resource to be burned by electric utilities, a practice now encouraged by current pricing policies, rate structures and environmental restrictions. Rate structures for natural gas as well as for electricity must be redrawn to discourage excessive consumption.

In the short run, New York City would benefit from low fuel prices. But when prices are artificially low, markets are distorted and long-term disruptions result, hurting the City along with the rest of the country because the supply of clean fuels is further impaired. So an enlightened City administration would discourage politically expedient but short-sighted fuel price freezes.

It is important that the present energy crisis not become an economic windfall for the major petroleum companies and that any increased revenues go toward expenditures which would help ease the crisis in the short and long terms. Changes in the corporate tax structure, an excess profits tax (which was dropped from pending legislation before the end of last session of Congress), and federally mandated energy exploration, production, research and development efforts are among the possibilities.

It is equally important that the energy crisis not become a vehicle for the oil companies, which have been enjoying record profits (see Fig. 17), unjustifiably to skirt the antitrust laws. Yet another danger is false and self-serving advertising about the energy crisis; this alleged practice has been criticized by the U.S. Environmental Protection Agency (47) and is under investigation by the Federal Trade Commission.(48)

Figure 17

Oil Company Profits*

(In Millions of Dollars)

COMPANY	1973 PROFITS	1972 PROFITS	INCREASE	1973 4TH QUARTER	1972 4TH QUARTER	INCREASE
Exxon	$2,440	$1,532	59%	$784	$493	59%
Texaco	1,292	889	45	454	267	70
Mobil	843	574	47	272	162	68
Shell	333	261	28	79	81	
Union	180	122	48	51	33	55
Cities Service	136	99	37	42	28	50

*Large companies that have reported so far. <u>Time</u>, February 4, 1974

Finally, much industry data on production, supply, and demand must be released if the energy industry is to regain the confidence of the public and, indeed, of the government. It is currently difficult if not impossible to determine the true extent and causes of the present crisis and the role of the oil companies.(49) As a result, many Americans feel the crisis is in part at least contrived by the companies to increase their already large profits.(50) Given the enormous impact on the nation by crucial energy decisions, these decisions cannot be left to the giant corporations and the secrecy of the boardroom. The interest of the directors and stockholders in maintaining maximum profits does not always agree with the interest of the public who wish an adequate energy supply. If the data are not voluntarily released by the companies, legislation is needed to obtain the data.

Energy and Administration(51)

Chaos is not too strong a word to describe the current state of government organization to meet the energy crisis. Energy "czars" come and go, organization charts are shuffled and reshuffled, and power struggles simmer below the surface or bubble to the top.

At the federal level, the country is plagued by the lack of an overall, comprehensive energy policy. President Nixon's several "energy messages" have lacked clear direction or thrust. Though there is movement toward federal reorganization of energy matters--notably the Federal Energy Office, under William Simon, and the proposed Energy Research and Development Administration--federal coordination of energy affairs has been spotty at best and it is doubtful that reorganization, needed as it is, can be a substitute for a comprehensive policy. The federal government was warned about the coming energy crisis many months before the

Arab embargo, but bureaucratic inertia and lack of strong leadership led to inaction. Instead, the government's moves have been scattered and ad hoc.(52) The President, the bureaucracies, the Congress and the states continue to snipe at each other, well past the time when decisions should have been made.

The situation is somewhat better at the state level but there is still a plethora of agencies with energy responsibilities, including the P.S.C., the Department of Environmental Conservation, the Interdepartmental Fuel and Energy Committee, the New York State Power Pool, the Power Authority of the State of New York, and the Department of Commerce. Governor Malcolm Wilson is now moving to consolidate at least some of these functions.

In New York City, power has been diffused among the Municipal Services Administration, the Interdepartmental Committee on Public Utilities, the Environmental Protection Administration, the Mayor's Emergency Energy Supply Task Force, and others. The dispute between the City and the state over whether Con Edison should be allowed to burn coal points to the lack of effective mechanisms for energy decision-making. Mayor Beame's action on January 23, creating a New York City Energy Office under Herbert Elish, is a significant move toward rationalizing and coordinating energy policy here.

It is important to remember that each level of government has its own natural role, and energy policy tasks should be apportioned accordingly. Neighborhood government units--as embodied in New York City's already extant 14 coordinated service districts--are most directly responsible for the health, comfort, and convenience of the citizens. They must act on the specific disruptions caused by energy flow--street openings, steam leaks, siting of smaller facilities, and so forth. The municipal government has the greatest ability to change transportation patterns, through taxes, tolls, municipal mass transit and so forth; to undertake public education programs, and to see that intracity electric, steam and gas transmission facilities are maintained properly.

The regional and interstate governments have special responsibility for offshore energy development and transportation, for major highway and intercity mass transit systems and for siting of major generating installations. The federal government must make the decisions which affect national security and balance of payments problems and therefore must decide how dependent the United States should be on foreign sources for energy. The federal government also has the greatest leverage of any government level in dealing with natural gas and gasoline pricing, increasing competition within the energy industry, enforcing pollution control laws, encouraging research and development, allocating clean fuels and similar matters.

Ultimately, inhabitants of the entire planet must make broad decisions about how much energy will be consumed, in what form and manner and over what periods of time, and how much energy will flow across the globe. If international institutional mechanisms are not established for these purposes, the community of man may find itself facing an unavoidable collision between unstoppable energy demands and exhausted energy supplies.(53) This collision could be catastrophic, but there is still time.

FOOTNOTES

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4. See Third Annual Report, Interdepartmental Committee on Public Utilities, p. 35.

5. Regional Plan Association and Resources for the Future, "Regional Energy Consumption," December, 1973.

6. Louis Harris, "Public Willing to Sacrifice to Cope with Energy Crisis," Washington Post, December 3, 1973; "Poll Finds Nearly 90% in U.S. Back Federal Curbs on Energy," (Gallup Poll), New York Times, December 20, 1973; National Opinion Research Center data, reported in press release, U.S. Department of Transportation, January 7, 1974.

7. Evidence of the large differences in energy efficiency among different brands of one appliance can be found in John C. Moyers, "The Room Air Conditioner as an Energy Consumer," Oak Ridge National Laboratory, Oak Ridge, Tenn. (ORNL-NSF-59).

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11. "Report of the Ad Hoc Committee on Energy Efficiency in Large Buildings" to the Interdepartmental Fuel and Energy Committee of the State of New York, March 7, 1973.

12. Ibid.

13. "Regional Energy Consumption," Op. Cit.

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20. N.Y.C. Environmental Protection Administration.

21. See Richard D. Lyons, "E.P.A. Loses Its Authority on Power Plant Radiation," New York Times, December 12, 1973.

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26. Science and Public Policy Program, University of Oklahoma, 1973.

27. Stephen A. Wakefield, Assistant Secretary, U.S. Department of the Interior, "The Atlantic Outer Continental Shelf", American Gas Association Monthly, September, 1973.

28. Address by Peter Peterson, U.S. Secretary of Commerce, before American Petroleum Institute, November 15, 1972.

29. President Nixon's Energy Message, April 18, 1973.

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41. See John Papamarcos, "Gas Turbines Face New Challenges," *Power Engineering*, December, 1973, pp. 30-37.

42. See "Causes of Schedule Delays in 28 Nuclear Plants Scheduled for 1973 Operation," chart presented at address by William O. Doub, Commissioner, U.S. Atomic Energy Commission, before the Atomic Industrial Forum annual conference, San Francisco, California, November 1, 1973.

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50. "Poll Finds Oil Crisis Laid to Government and Big Companies," New York Times, January 10, 1974.

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POSSIBLE MEASURES (not recommendations) — IMMEDIATE IMPACT

Measure	Affects	Through	NYC Area Environmental Impact	Implem. By	Pro	Con	Page(s) Discussed
Selective taxi cruising ban	Demand	Operating change	Reduces air pollution	NYC	Very effective	Taxi industry, driver resist.; convenience	15
Toll bridges, tunnels	Demand	"	"	NYC	", generates revenue	Driver resist.; equity problems	15
Restrict Manhattan parking	Demand	"	"	NYC	Very effective	"	15
Reduce lighting, heating	Demand	"	Reduces all energy use	Any level, or private	Inexpensive & effective	Comfort; enforcement difficulties	10-12
Voltage reduction	Supply	"	"	NYS P.S.C.	"	Uncertain long-term impact	13

* This index is keyed to the possible measures used throughout this report.

POSSIBLE MEASURES (not recommendations) — Short-Term (Effects in 0 to 3 Years)

Measure	Affects	Through	NYC Area Environmental Impact	Implemented By	Pro	Con	Page(s) Discussed
Shift refinery production from Gasoline to #2 oil	Supply	Operating Change	--	U.S., private	Diverts crude oil	Reduces gasoline supply	2
Clean fuels allocation	Supply	Distribution	Reduces air pollution	U.S.	Helps NYC air quality	Rural resist.; complicated	3
Appliance Labeling	Demand	Education	Reduces all energy use	Any level, or private	Inexpensive & effective	--	8
Improve Building Insulation	Demand	Capital Expenditure	Reduces all energy use	"	Effective	Expensive	12
Improve Building Maintenance	Demand	Operating Change	Reduces all energy use	"	Effective	Possible landlord resistance	11-12
Restrict large Automobiles	Demand	Production or operating Change	Reduces all energy use	Any level	Effective	Industry-consumer resistance	15
Train motor vehicle mechanics, inspectors	Demand	Operating Change	Reduces all energy use	Any level	Inexpensive, very effective	--	15
Rationalize goods delivery	Demand	Operating Change	Reduces all energy use	Any level	Very effective	Industry resistance	15
Grant clean fuels rules variances	Supply	Operating Change	Increases air pollution	US or NYC	Increases usable supply	Avoidable, env. impact	17-18
Allow leaded gasoline	Supply	Operating Change	Increases air pollution	Any level	"	"	19
Transmission, distribution facility maintenance	Supply	Operating Change	--	NYS PSC, private	Improves reliability of supply	--	32-33
Allow gas turbine units	Supply	Capital Expenditure	Nitrogen emissions	NYS, NYC	Improves peak, base supply	Env. impact, fuel inefficiency	39
Change electric rates	Demand	Economics	Reduces energy use	NYS PSC	Demand, peak reduction?	Equity prblms; efficiency?	42-44
Deregulate natural gas	Demand	Economics	"	US FPC	Demand reduction	"	45
Regulate energy advertising	Demand	Operating Change	"	US FCC or FTC	"	Unknown impact, much resistance	44
Excess profits regulation	Supply	Operating Change	?	US	Supply increase	"	44
Government reorganization & policy formulation	Planning regulatn	Operating Change	?	All levels	Present system is ineffective	"	20; 30 46-49
Information release requirements	Regulation	Facilitates Enforcement	?		Needed for decision making	Possible industry resistance	45-46

POSSIBLE MEASURES (not recommendations) — Medium-Term (Effects in 4-7 years)

Measure	Affects	Through	(NYC) Environmental Impact	Implemented By	Pro	Con	Pages(s) Discussed
Better building design	Demand	Construction change	Reduces all energy use	Change bldg. code	Very Effective	Bureaucratic, Indust.Inertia	12
Energy impact assessments	Demand	Planning	"	Any level	"	"	13
Improve mass transit systems	Demand	Operating and Capital	Reduces auto use	Any level, especially NYC	"	Expensive	13 - 15
Require catalytic converters	Adverse Demand	Capital change	Reduces air pollution	U.S.	Reduces air pollution	", increase fuel consump. & some emiss.	18 - 19
Burn refuse, waste oil	Supply	Research & Development	Red. solid waste, water pollution	U.S., NYC	Multiple benefits	Cost?	24 - 25, 40 - 41
Deepwater ports	Supply	Construction	Onshore development problems	U.S., NYS	May reduce oil spills, economics	Onshore dev.; uncertain crude supply	27 - 29
More storage facilities	Supply	"	Possible leakage, aesthetics	NYS, NYC, private	May be needed	Environmental impact	30 - 32
More refinery construction	Supply	"	Possible pollution, aesthetics	"	"	" "	33 - 35
Build Cornwall plant	Supply	"	Water poll., fish kills, air poll., aesth.	Approvals from U.S., N.Y.S.	Increases peak capacity	Env. impt.; consumes fuel	38 - 39
Build "total energy" and on-site generating plants	Supply	"	Some air pollution	Approvals from NYC	More efficient than present systems	Possible pollution	39

POSSIBLE MEASURES (not recommendations) Long-Term (Effects after 8 years)

Measure	Affects	Through	(NYC area) Environmental Impact	Implemented By	Pro	Con	Page(s) Discussed
Truck by-pass	Demand	Capital change	Reduces air pollution	Any level	Diverts traffic from Manhattan	Expensive	15
Denser land Development	Auto use	Planning	Reduces all energy use	NYS, NYC	Encourages mass transit use	Mass resist. & implemen. problems	15
Develop alt. fuel sources (solar, gasif.)	Supply	Research & Development	Mixed	U.S.	Self-sufficiency; reduces fuel depletion	?	21, 22 24, 39-40
Offshore oil production	Supply	Exploration, capital change	Increases water pollution, coastal development problems	U.S.	Increases supply	Environmental impact	25 - 27
Preserve rail links	Supply	Maintenance	- - - -	U.S., NYC	May be needed for gasification	- - - -	32
Coal gasification	Supply	Research & Development	Possible Pollution	"	Increased clean fuels supply	Environmental impact	32, 36
Build new large generating stations	Supply	Construction	"	Approvals from all levels	May be needed	Environmental impact	38 - 41
Antitrust actions	Supply	Changing Industry Structure	?	U.S. action or NYS, NYC suits	Reduces domination of oil industry by huge corporations	Unknown impact, much resistance	44
Better plant siting regulations	Supply	Planning	Reduces air pollution	Regional, NYS, NYC	Rationalizes system, speeds process	Political, industrial resistance	39 - 40

Appendix II

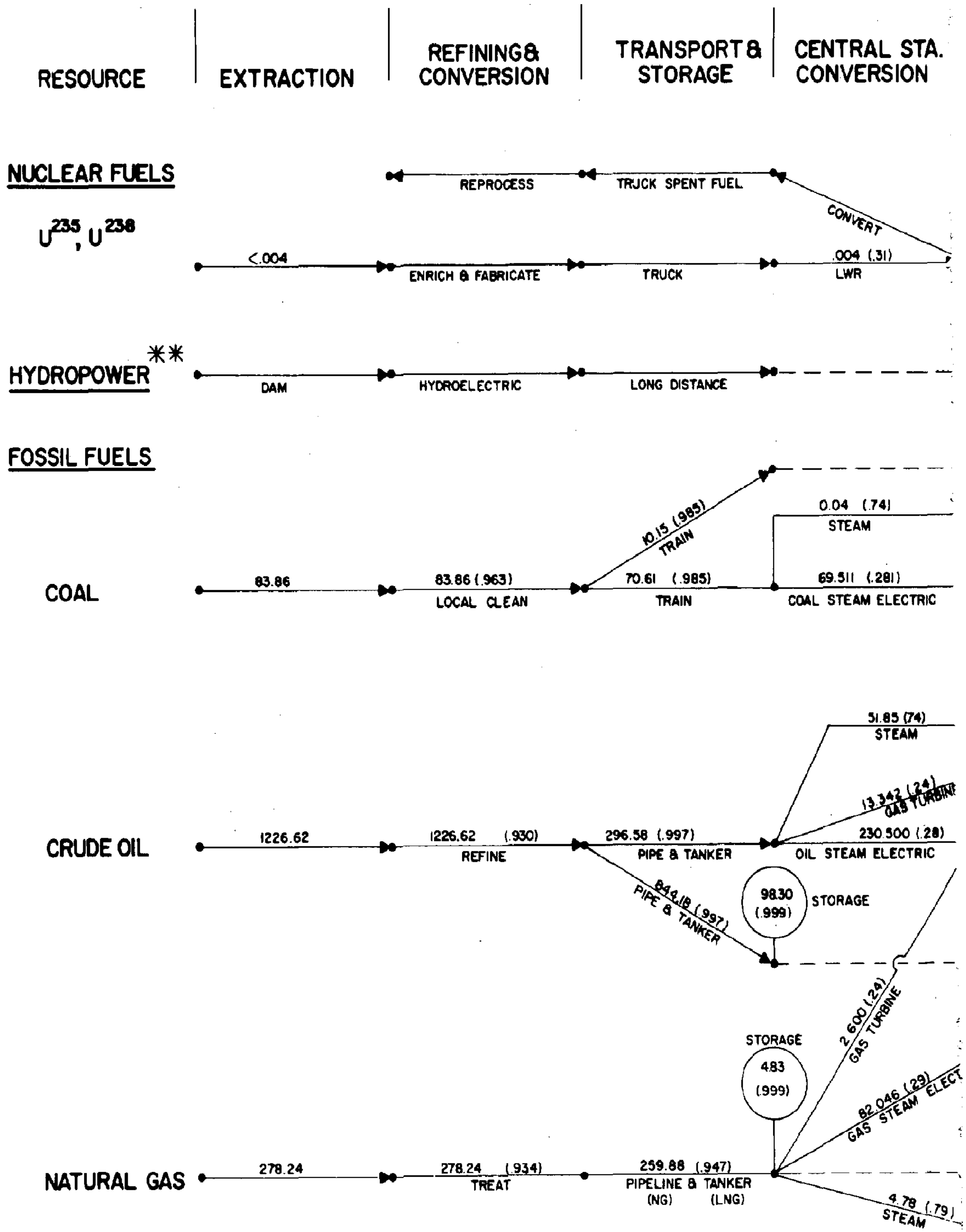
Growth in Energy Consumption and Related Indicators, 1960-1970

			New York City number	New York City annual % growth	Region (31 counties) number	Region (31 counties) annual % growth	Region outside NYC number	Region outside NYC annual % growth	United States annual % growth
POPULATION *(thousands)*		1970	7,896	0.1	19,756	1.2	11,860	1.9	1.3
		1960	7,782		17,624		9,842		
MONEY INCOME *(million 1969 $$)*		1970	29,373	3.0	76,313	4.1	46,940	4.8	4.6
		1960	21,873		51,211		29,338		
EMPLOYMENT *(thousands)*		1970	4,194	0.7	8,624	1.6	4,430	2.6	1.8
		1960	3,908		7,333		3,425		
FLOORSPACE:	residential *(million sq. ft.)*	1970	2,562	0.9	6,460	2.1	3,898	3.1	n.a.
		1963	2,404		5,559		3,155		
	nonresidential *(mill. sq. ft.)*	1970	1,335	1.0	3,918	2.1	2,583	2.8	n.a.
		1963	1,244		3,369		2,125		
PERSON-MILES OF TRAVEL *(billions)*		1970	38	2.4	134	3.0	96	3.2	4.0
		1960	30		100		70		
TON-MILES OF FREIGHT *(billions)*		1970	n.a.		421	2.5	n.a.		3.1
(exclusive of pipelines)		1960	n.a.		328		n.a.		
NET ENERGY CONSUMPTION *(trillion Btu)*		**1970**	**1,097**	1.5	**3,398**	2.8	**2,301**	3.4	3.7
		1960	**945**		**2,587**		**1,642**		
BY SECTOR:	RESIDENTIAL	1970	420	−0.3	1,071	1.3	651	2.5	3.8
		1960	434		944		510		
	COMMERCIAL & PUBL. FACIL.	1970	309	2.6	870	2.8	561	2.9	4.3
		1960	240		662		422		
	INDUSTRIAL	1970	67	0.5	316	2.2	249	2.7	2.9
		1960	64		254		190		
	TRANSPORTATION	1970	302	3.8	1,140	4.6	839	4.9	4.3
		1960	207		727		520		
RESIDENTIAL:	electricity	1970	29	7.6	98	8.6	69	9.1	8.1
		1960	14		43		29		
	gas	1970	96	5.9	295	6.2	199	6.4	4.6
		1960	54		161		107		
	other	1970	295	−2.1	678	−0.9	383	0.2	1.0
		1960	366		740		374		
COMM. & PUBL. FAC.:	electricity	1970	43	6.0	113	8.1	70	9.6	10.4
		1960	24		52		28		
	gas	1970	35	2.3	129	8.3	94	12.1	7.0
		1960	28		58		30		
	other	1970	231	2.1	628	1.3	397	0.9	1.8
		1960	188		552		364		
INDUSTRIAL:	electricity	1970	17	3.5	72	5.8	55	6.6	5.4
		1960	12		41		29		
	gas	1970	20	2.3	91	9.1	71	12.4	4.9
		1960	16		38		22		
	other	1970	30	−1.8	153	−1.3	123	−1.2	−0.2
		1960	36		175		139		
BY ENERGY FORM:	electricity	1970	98	5.2	293	7.2	195	8.4	7.4
		1960	59		146		87		
	gas (except for electricity generation)	1970	151	4.4	516	7.2	365	8.7	5.1
		1960	98		257		159		
	coal (except for electricity generaton)	1970	15	−11.5	52	−11.0	37	−10.7	−1.0
		1960	51		166		115		
	transportation fuels	1970	292	4.0	1,130	4.7	838	4.9	4.3
	(gasoline and kerosene)	1960	198		717		519		
	heating fuels and steam	1970	541	0.1	1,407	0.8	866	1.3	2.1
	(incl. LPG, distillate & residual)	1960	538		1,302		764		
Fuel for electricity generation in area & steam loss		1970	401	4.4	1,058	7.3	657	9.7	6.7
		1960	260		520		260		
Fuel for electricity imported into area		1970	3	14.9	22	−1.6	19	−5.0	n.a.
		1960	−13		26		39		
GROSS ENERGY CONSUMPTION		**1970**	**1,404**	2.2	**4,186**	3.4	**2,782**	4.1	4.0
(trillion Btu)		**1960**	**1,133**		**2,988**		**1,855**		

Source: "Regional Energy Consumption"

Appendix I

Preliminary Reference Energy System for New York City, 1970*



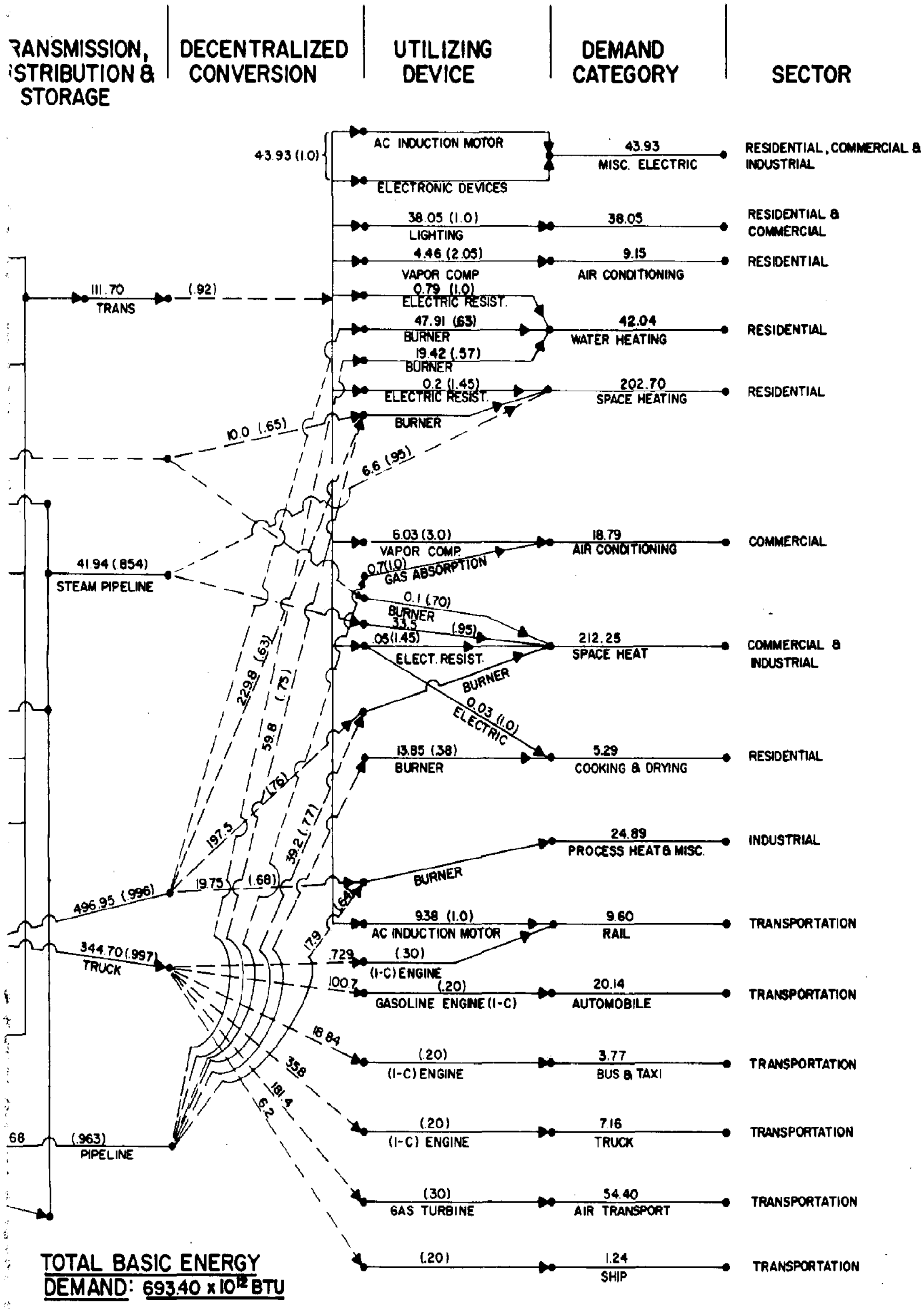
TOTAL RESOURCE CONSUMPTION: 1,588.72 x 10^{12} BTU

NOTES

*ENERGY FLOWS ARE INDICATED IN 10^{12} BTU ABOVE EACH ELEMENT. CONVERSION EFFICIENCIES ARE INDICATED IN PARENTHESES.

** ENERGY FLOWS FROM HYDROPOWER DO EXIST, BUT ARE EXTREMELY SMALL AND THEREFORE OMITTED

Prepared by Brookhaven National Laboratory and the State University of New York--Urban and Policy Science Program under a grant from the National Science Foundation, RANN Grant AG-429. December 6, 1973



TRANSMISSION, DISTRIBUTION & STORAGE
DECENTRALIZED CONVERSION
UTILIZING DEVICE
DEMAND CATEGORY
SECTOR
43.93 (1.0)
AC INDUCTION MOTOR
ELECTRONIC DEVICES
43.93
MISC. ELECTRIC
RESIDENTIAL, COMMERCIAL & INDUSTRIAL
38.05 (1.0)
LIGHTING
38.05
RESIDENTIAL & COMMERCIAL
4.46 (2.05)
VAPOR COMP
9.15
AIR CONDITIONING
RESIDENTIAL
111.70
TRANS
(.92)
0.79 (1.0)
ELECTRIC RESIST.
47.91 (.63)
BURNER
19.42 (.57)
BURNER
42.04
WATER HEATING
RESIDENTIAL
0.2 (1.45)
ELECTRIC RESIST.
BURNER
202.70
SPACE HEATING
RESIDENTIAL
10.0 (.65)
6.6 (.95)
6.03 (3.0)
VAPOR COMP.
0.7 (1.0)
GAS ABSORPTION
18.79
AIR CONDITIONING
COMMERCIAL
41.94 (.854)
STEAM PIPELINE
0.1 (.70)
BURNER
33.5
(.95)
.05 (1.45)
ELECT. RESIST.
212.25
SPACE HEAT
COMMERCIAL & INDUSTRIAL
BURNER
0.03 (1.0)
ELECTRIC
229.8
(.63)
(.75)
59.8
13.85 (.38)
BURNER
5.29
COOKING & DRYING
RESIDENTIAL
(.76)
39.2 (.77)
197.5
24.89
PROCESS HEAT & MISC.
INDUSTRIAL
496.95 (.996)
19.75
(.68)
BURNER
(.64)
9.38 (1.0)
AC INDUCTION MOTOR
9.60
RAIL
TRANSPORTATION
344.70 (.997)
TRUCK
17.9
.729
(.30)
(I-C) ENGINE
100.7
(.20)
GASOLINE ENGINE (I-C)
20.14
AUTOMOBILE
TRANSPORTATION
18.84
(.20)
(I-C) ENGINE
3.77
BUS & TAXI
TRANSPORTATION
35.8
181.4
6.2
68
(.963)
PIPELINE
(.20)
(I-C) ENGINE
7.16
TRUCK
TRANSPORTATION
(.30)
GAS TURBINE
54.40
AIR TRANSPORT
TRANSPORTATION
(.20)
1.24
SHIP
TRANSPORTATION
TOTAL BASIC ENERGY DEMAND: 693.40 x 10^12 BTU

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